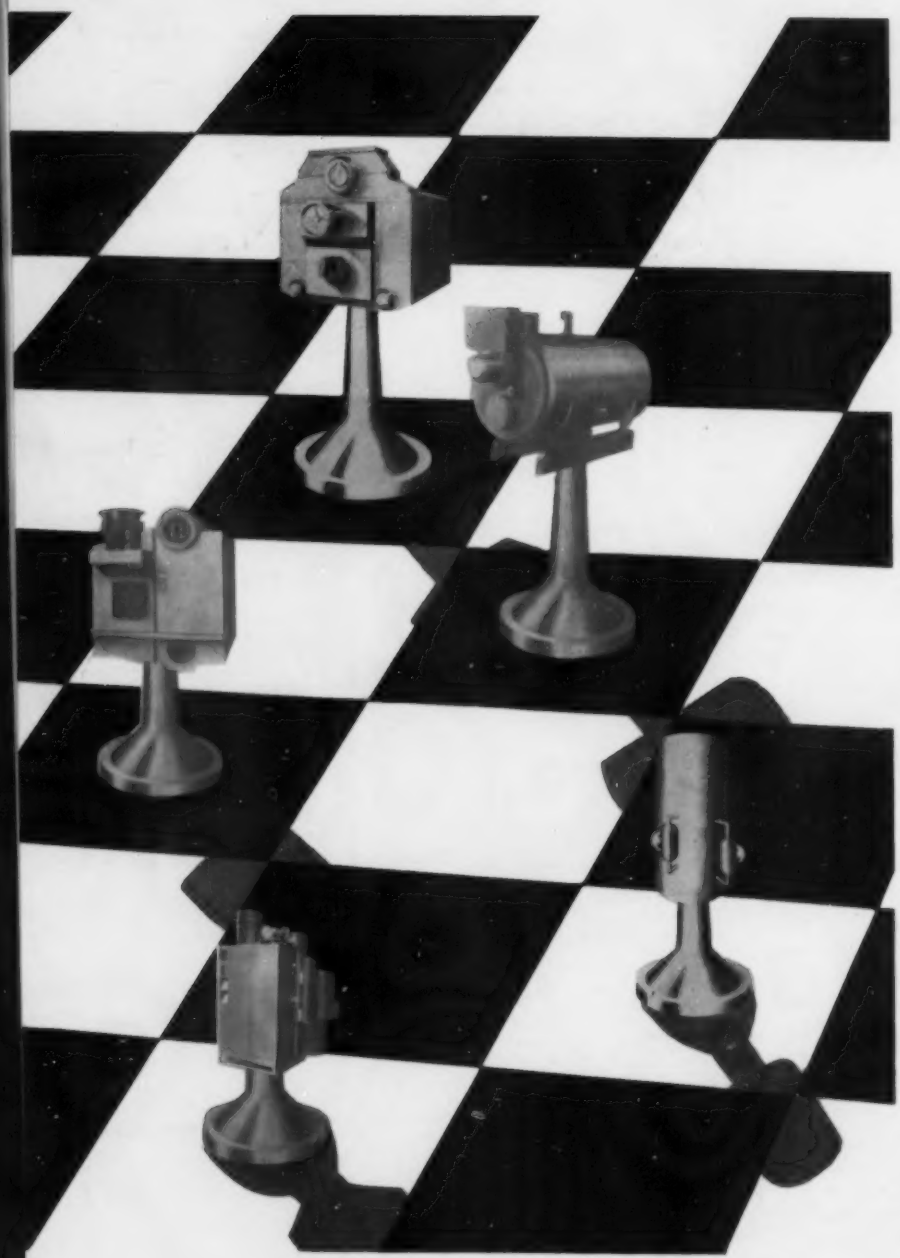
Industry and Power



May 1954

Packaged Boilers

A special, 24-page, staff prepared report on recent developments in design and construction of packaged boilers and accessories.
Starts on page 67

Special Lighting Problems

Critical seeing tasks in industry present unusual problems with interesting solutions 63

Wire Thread Inserts

Wire inserts solve many maintenance problems where threads are worn or stripped 91

Compressed Air

Ford's Cleveland Foundry is a good example of smart engineering of a compressed air system 94

Centrifugal Pump Controls

How to select the right controls for any type of centrifugal pump used in industry 98

Pipe Hangers

Pipe hangers are simple items that do an important job. Be sure the right hangers are used ...100

Leather Belts

A collection of handbook data needed by every belt user...105

for engineers and executives responsible for

— engineered plant facilities

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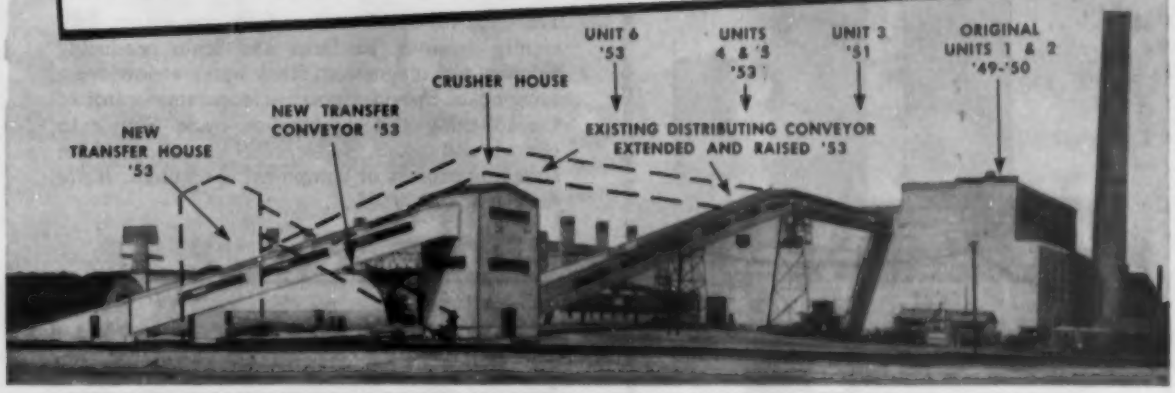

Dotted lines show additions since 1950 to original White River station of Indianapolis Power & Light. Two units were added without change in the coal handling system. However, a fifth unit was built in 1953, requiring the above change in the system. Provision was made at this time for a future sixth unit.

For the fourth time in recent years, Indianapolis Power & Light relies on Link-Belt coal handling equipment and experience

PROOF of the versatility of Link-Belt engineering is the White River station of Indianapolis Power & Light. Not only did the initial plans provide for future expansion, but when loads exceeded the forecast, Link-Belt—working with IPL's consultants, Gibbs & Hill—designed a low-cost revamp of the coal handling system that can fuel two additional generating units.

So smoothly was the changeover accomplished that the station was back on the line in 12 hours. And you, too, will find it pays to put the experience gained on hundreds of power plant jobs to work for you.

Link-Belt can offer all types and sizes of equipment for unloading, storing, reclaiming, conveying, elevating and feeding your coal.

Your nearby Link-Belt sales representative will be glad to work with you and your consultants . . . help analyze your coal handling requirements. And be sure to ask him for a copy of Book 2410 that shows the latest in equipment and layouts for power plants large and small.

Distributing belt conveyor rolls on 36-in. Link-Belt roller bearing idlers. Coal is discharged to bunkers by self-propelled tripper that opens and closes bunker seals to confine dust.

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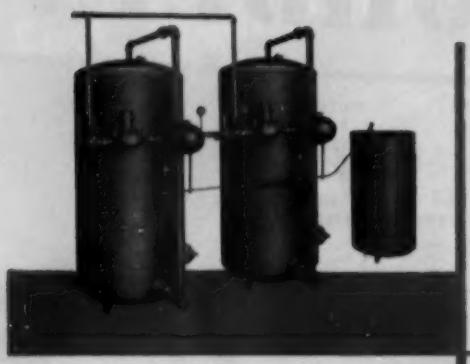

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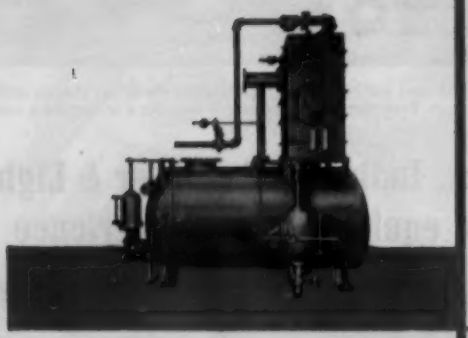

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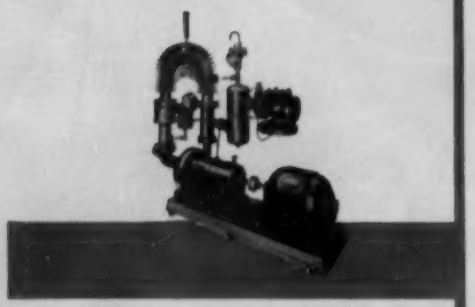

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Industry and Power

Published by Industry and Power Publications

VOLUME 66 — **May 1954** — NUMBER 5

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Extra Light for Critical Seeing 63
E. A. Linsday, Application Engineering Dep't., General Electric Co.

The Packaged Boiler Picture — Special Report 66

A staff prepared 24-page report to the readers of Industry & Power— dealing with the developments in packaged boilers in the past few years. This carefully prepared and fully illustrated article summarizes the current fields of application for packaged units and points to the future.

Additional copies of this report are available. Use coupon on page 145.

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Established May 1920

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. . . recently announced . . . worth watching

Nickel-Saving Alloy

• Research sponsored by Alloy Castings Institute has resulted in discovery that alloy containing about 20 percent chromium and 9 percent nickel can effectively substitute for one containing about 26 percent chromium and 12 percent nickel in intermediate temperature ranges.

This finding is important because trends toward higher operating temperatures in some industries, notably power plants, are pushing low-alloy materials now used for furnace construction to their limits of usefulness. Availability of cast "HF" alloy usable above these limits will permit engineers to take advantage of efficiency of higher temperature operation without having to use higher-nickel alloys.

Less Noise

• The National Association of Mutual Casualty Companies has a very active interest in problems concerning possible hearing impairment suffered by industrial employees. A recently completed two year program included: A survey of noise conditions in many plants representative of American industry; a manual dealing with noise measurements for industry people who deal with such problems; and a manual on methods of reduction and control of noise in industrial plants.

Water-Resistant Insulation

• Development of a new water resistant insulation has been announced by The Magnesia Insulation Manufacturers Association. The new form of 85 percent Magnesia for hot piping and equipment offers a solution to the important problem of insulation damage resulting from severe water exposure.

Tests indicate that immersion in boiling water for 378 hours with intermittent drying on hot pipes caused only a slight roughening of the insulation surface with no loss of insulating values. Following the tests, the new product was still in serviceable condition.

Plant Maintenance Survey

• The close relationship between progressive maintenance practices and high productivity is pointed up in a survey of U. S. industrial plants by a visiting British productivity team. The report reviews such U. S. practices as the design of plants to include strategic location of lifting and other labor saving devices, properly placed track and runways, and the special design of equipment for ease in handling, servicing, inspection, and replacement. Emphasis is also placed on simplification of maintenance by use of such mobilized equipment as lubrication trucks, straddle trucks, mobile cranes, and motor scooters.

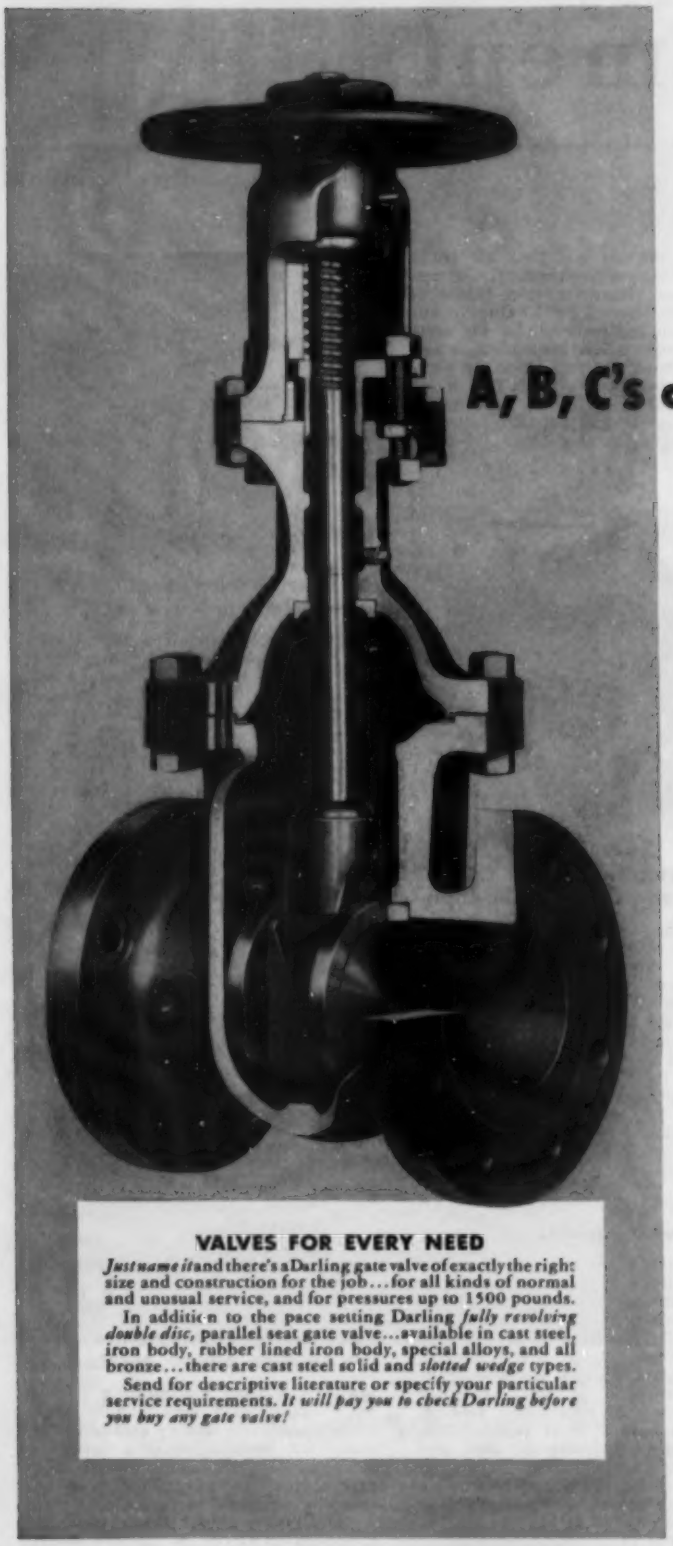
More Power for Less

• Power plants are judged by the amount of fuel they use to produce a kilowatt-hour of electricity. Forty years ago it took about three and a half pounds of coal to produce a kilowatt-hour. Nowadays, the average is about one pound. And according to the latest Federal Power Commission figures, one of the lowest consumers uses as little as 11.9 ounces of coal per kilowatt-hour. Engineers are now building a new unit which they hope will further reduce this figure to 11 ounces of coal per kilowatt-hour.

Better Fuel Practices

• Recommended technical practices widely used in the U. S. and described in some detail in a recent Dept. of Commerce publication include: Better coal-sizing and smoke control; mechanical handling of coal and ash; automatic controls in boiler plants; prefabricated steam distribution systems; heat exchangers for heat recovery; automatic water softening plants; and de-aerating feed water heaters. Also contributing to U. S. power-plant efficiency are the widely used bent-tube, two-drum type of boiler; the cyclone furnace; mechanical stoker; portable instruments for gas analysis and temperature measurement; and steam-air meters and recorders with automatic combustion control.

The report points out, too, how fuel economy may be achieved by better cooperation between consumer and producer, by the interchange of supplies between the consumer and the supplying company, and through the cooperative use of central sources of power and heat.



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Just name it and there's a Darling gate valve of exactly the right size and construction for the job... for all kinds of normal and unusual service, and for pressures up to 1500 pounds.

In addition to the pace setting Darling *fully revolving double disc*, parallel seat gate valve... available in cast steel, iron body, rubber lined iron body, special alloys, and all bronze... there are cast steel solid and *slotted wedge* types.

Send for descriptive literature or specify your particular service requirements. *It will pay you to check Darling before you buy any gate valve!*

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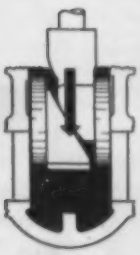
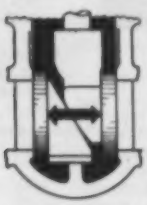
A, B, C's of better valve service with DARLING Revolving Disc GATE VALVES



GATE DESCENDING

A EXTRA LIFE

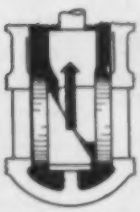
Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



GATE CLOSED

B POSITIVE CLOSING

Faces of the upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressures and tight closing despite valve body distortion.



GATE RISING

C EASIER OPERATION

Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation and greatly prolonged valve life!

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

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new equipment

. . . new developments

Packaged boiler features silent operation

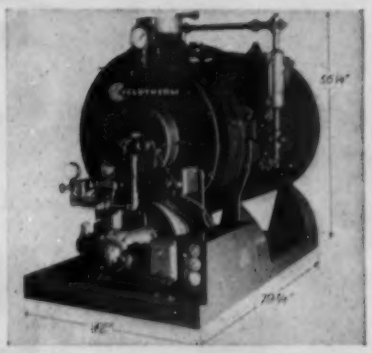
E10 Compact packaged boiler known as the "CB" has been announced by the Cleaver-Brooks Co. for use in commercial, industrial, and institutional structures. For processing or heating, steam or hot water use, it is said to offer big boiler performance in small units of 15 to 40 hp capacity. Features are silent operation, the "Fireeye" electronic combustion safety control, and maximum accessibility for operation and maintenance.

Maintenance cost low with use of aluminum jacketing

E11 Low cost protection for insulated pipelines and equipment, both inside the plant and outdoors, is provided by Al-Cor-Jac sheet aluminum jacketing, a product of the Aljon Manufacturing Co., Inc. Corrugated for strength, expansion, and contraction, the material is light and easy to handle, and vapor, weather, vermin, and fire proof. On new lines, yet to be insulated, conventional canvas covering and painting may be eliminated. On existing lines, jacketing can be applied directly over present canvas covering.

Steam traps heat steam units faster

E12 Heat-Kwik Super-Silvertop Steam Trap, developed by the V. D. Anderson Co. is reported on the basis of tests to vent air out of steam consuming units eight times faster than ordinary inverted bucket traps, and three times faster than air eliminator or blast type traps. These new steam traps require a trap factor of never more than 2 to 1. Due to the construction of the head of the trap, it may be opened for inspection or servicing without removal from the pipeline. The traps are available in a range of sizes from ¾ to 1¼ in., suitable for pressures up to 150 psi. Literature is available.



Smaller steam boiler requires no cement foundation

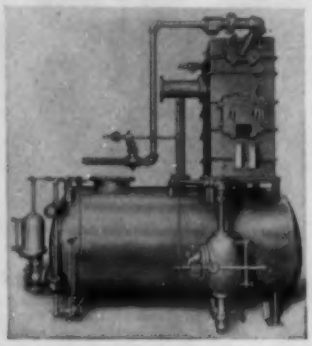
E13 Only 20-sq ft of floor space and less than 5 ft of head room are needed for the 50 hp fire tube steam boiler manufactured by Cyclotherm Division of United States Radiator Corp. Known as C1725, it requires no cement foundation or stack. A flue vent is said to be all that is necessary to operate it at about 80 percent efficiency. Multiple unit installations can be made. The package unit weighs only 3550 lbs.

Insulation tape also serves as gasket

E14 Presstite No. 165 anti-sweat insulation tape for cold water lines and air conditioning and refrigeration equipment is announced by Presstite Engineering Co. It also serves as a gasket for metal flanges, wood and glass, and as a sound deadener or cushioner. A black, rubbery tape composed of rubberized asphalt, cork and asbestos, it is non-volatile, odorless, highly resistant to water, and has excellent adhesion to surfaces such as glass or metal. The tape retains its flexibility, adhesion, and cohesion at temperatures as high as 158 and as low as -20 F. It is furnished in sizes ⅛ in. thick by 1 in., to 7 in. wide.

Smaller camera uses lower lighting levels

E15 For industrial television installations where a smaller camera having high resolution and using lower lighting levels is desirable, Diamond Power Specialty Corp. has developed a new camera known as Model 300-BV, which can be used instead of or interchangeably with the standard Utiliscope Model 300-B camera. It can be placed in practically any location . . . no matter how remote, dangerous, or inaccessible. One or more viewing screens are located wherever convenient to the operators. A bulletin is available.



Package type deaerators for smaller power plants

E16 Cochrane Corporation has announced a new line of deaerators completely factory assembled and ready for installation in a variety of storage tank sizes. Called the UNIPAC deaerator, it is a package type unit specially designed for small and medium size power plants. Outlet capacities range up to 60,000 lb per hr; storage tank capacities range from 35 to 250 cu

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 34/35—114/115.

$9,000 a year saved

by Royal Yarn Dyeing Corp. with p·k waste water heat reclaimer

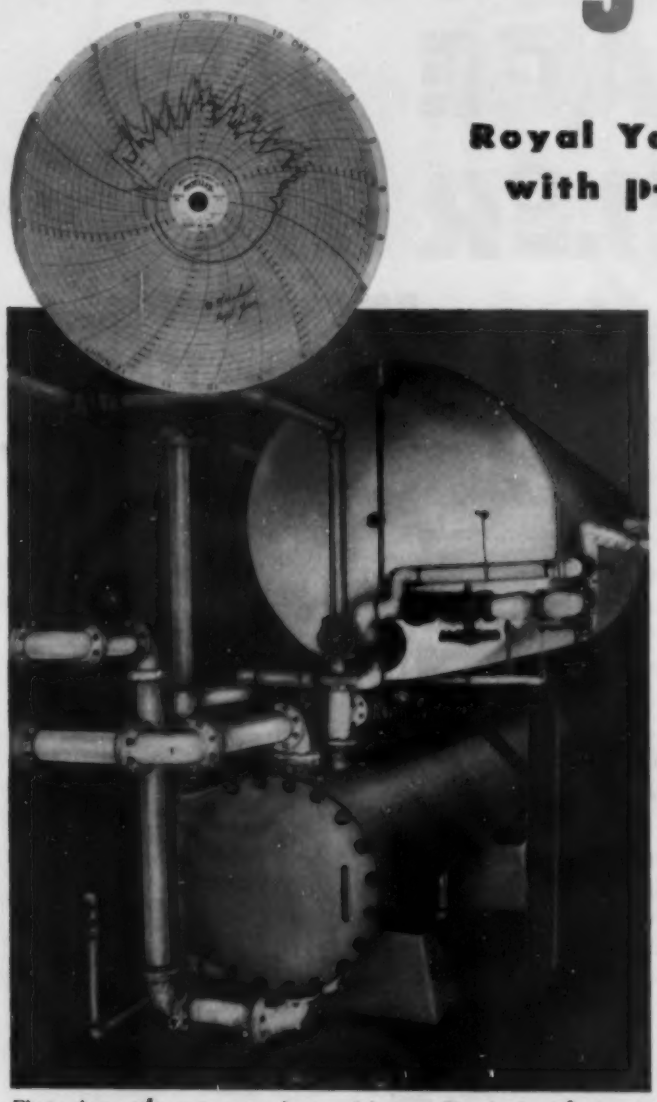


Photo shows p·k waste water heat reclaimer at Royal, plus p·k cement lined hot water storage heater. Chart authenticated by Mr. Kershaw, shows typical twelve hour day operation. Incoming city water is heated from 48° to 105°, without cost by the p·k waste water heat reclaimer.

Since they installed a p·k waste water heat reclaimer, Royal Yarn Dyeing Corp. of Brooklyn regularly save a minimum of 600 gallons of fuel oil each day, costing 6 cents a gallon.

Mr. Milton Kershaw, the Chief Engineer at the plant, says, "The p·k waste water heat reclaimer represents an additional 100 horsepower in working load." By taking hot waste water from dyeing vats and running it through the p·k heat reclaimer, city water temperature is increased from an average 48° to 105°. Heating incoming cold water in this way costs the company *nothing* – and has eliminated the need for additional boiler capacity.

If you are presently dumping hot process water down the drain, or not getting the maximum waste heat recovery from your present equipment, you can get the right facts and figures from p·k without obligation. Write now and ask for catalog #310.

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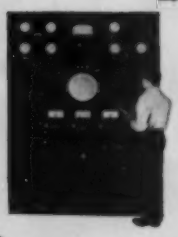
for the man considering a PACKAGE BOILER

new all-electric METERING TYPE PACKAGED CONTROL by HAYS



Now available for *all* makes and sizes of water tube type package boilers is the new all-electric, metering type Hays packaged control.

Metering type control provides maximum combustion efficiency regardless of the fuel burned because it *actually meters* the fuel flow and air flow, and automatically maintains the desired ratio. No adjustments are needed when changing fuels or oil burner tips.

All-electric operation includes not only safety devices but also steam, fuel, and air controllers and valves—uses only the normal source of AC voltage. No compressed air is required.

Fully automatic, safe and reliable operation is assured because Hays maintains the same industrial quality built into the largest utility combustion control system and it is factory tested before shipment.

Complete package in one simple and inexpensive to install panel board.

Write today for fact-filled Bulletin 53-1088-239.

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

THE hays CORPORATION

MICHIGAN CITY, 2, INDIANA

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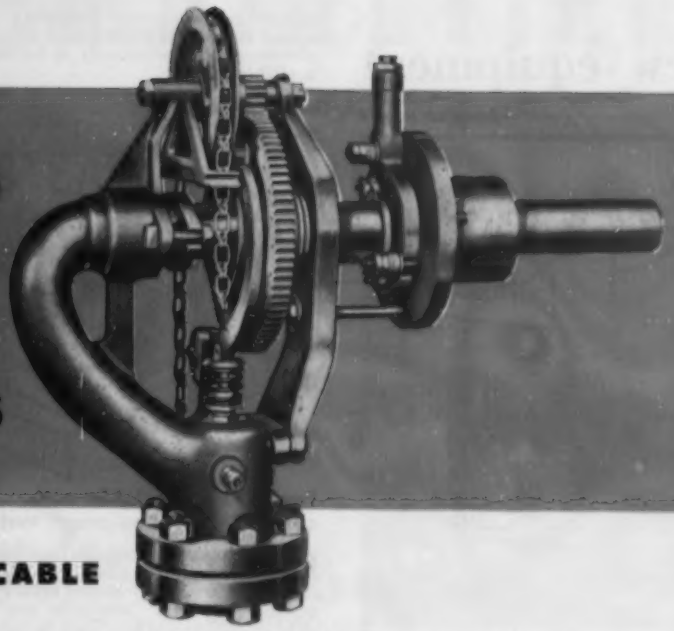
DIAMOND G9B SOOT BLOWERS



UNIVERSALLY APPLICABLE TO *ALL* PACKAGE TYPE BOILERS

(Water Tube)

Among the more than 250,000 Diamond G9B Soot Blowers that have been installed on water tube boilers are units in practically every make of package type water tube boiler.

The exceptional cleaning of package type boilers done by G9B Soot Blowers results from the many advantages of G9B design and construction. Among them are: (1) Positive automatic valve action with no critical adjustment for tight seating. (2) Poppet type valve is simple and reliable. (3) Minimum number of moving parts. (4) Direct positive gear drive. (5) All working parts readily accessible for maintenance.

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In Both Design and Materials

Diamond blower elements are superior in design, materials and construction. Made of extra heavy wrought seamless tubing, distal ends are closed by a special forge-rolling process that produces end closure integral with and heavier than the wall. Nozzles are expanding type that provide maximum cleaning velocity. There is a correct element material for every temperature condition. The three materials have these maximum temperature limits: Steel 900° F; Calorized (aluminum impregnated inside and out) 1600° F; Dialoy (high chromium content) 1900° F.

WELDED BEARINGS

They can't slip and the welded contact with the tube provides cooling so they do not burn. They eliminate the possibility of excessive element strain that causes warped or broken elements, or misaligned nozzles.

Ask for a copy of new Bulletin 1137X.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario

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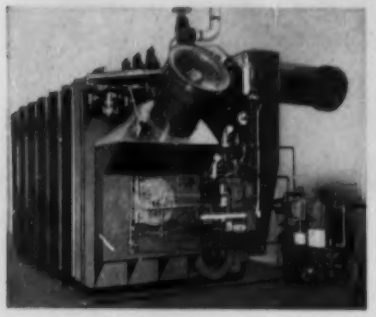
new equipment

—Starts on page 8

ft. They are available in both right and left hand types—the type being determined by location of steam inlet facing tray door. Literature is available.

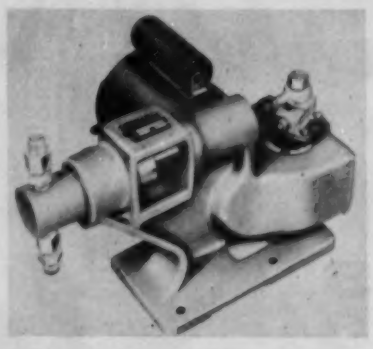


Package boiler unit installed quickly

E17 Type H pre-assembled, water-tube steam generators manufactured by the Bigelow Co. are shipped complete—ready to operate as soon as service connections are made. The unit package includes drums, tubes, refractory, steel casing, burner, controls, automatic safety detectors, and soot blowers. No special foundations are necessary since the heavy steel base, which functions as a skid for erection, acts as a support when the boiler is in place. Fired by oil or gas, the boiler is a two drum design with vertical bent-tube arrangement and a water cooled furnace. The unit is adaptable to outdoor service and can be moved easily because of its compact design.

Impeller has built-in shaft sleeve

E18 Designed and constructed for air-conditioning and refrigeration service, Ingersoll-Rand Company's centrifugal pump, ¾ KRUSA Motorpump, is a single stage, 3450 rpm unit. Die-cast bronze balanced impeller has a built-in shaft sleeve to prevent motor shaft corrosion. Standard jet pump motors ⅛ thru 1 hp are used, and the pump will deliver capacities to 48 gpm at heads to 100 ft. Mechanical seal consisting of a rotating ceramic face against a stationary "Teeplelite" face is said to prevent stuffing-box drips and eliminate motor overloads. A bulletin is available.



Pumps are available with open or explosion-proof motors

E19 Proportioneers, Inc. announces new models and improvements in the design of their Model 1105-S proportioning pump. Originally available only as a 10-gallon per hour pump with one motor voltage, it is now offered as either a 10 or a 20 gal an hour pump with open or explosion-proof motors, and in a variety of voltages. Bulletin describes the complete line of pumps.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pgs. 34/35 & 114/115. Your requests will be handled promptly.

Silicone protected motors available for outdoor drives

E20 Full protection against moisture and corrosion is said to be provided in a line of weather-protected squirrel-cage induction motors being built by Electric Machinery Mfg. Co. Called Sil-Clad, these motors feature complete silicone insulation on the motor winding, silicone enamel baked on all exposed metal parts of the motor, and stainless steel on parts subject to air abrasion. The motors are offered in ratings of 250 hp and larger. Bulletin gives technical information.

Conveyor belt fabric has high moisture resistance

E21 Lightweight industrial conveyor belts, including Koroseal belts and others with an "eye-rest" green color for inspection service, are announced by The B. F. Goodrich Co. Koroseal belts have a smooth non-porous surface that resists flaking or checking and eliminates the danger of contamination of materials handled. The "Economy" black belt is designed for low cost operation. A new, lightweight conveyor belt fabric, identified as C. P. special conveyor fabric, has high resistance to moisture when impregnated with special compounds and has long flex life even when operated over small pulleys.

Small control drive improves flow control

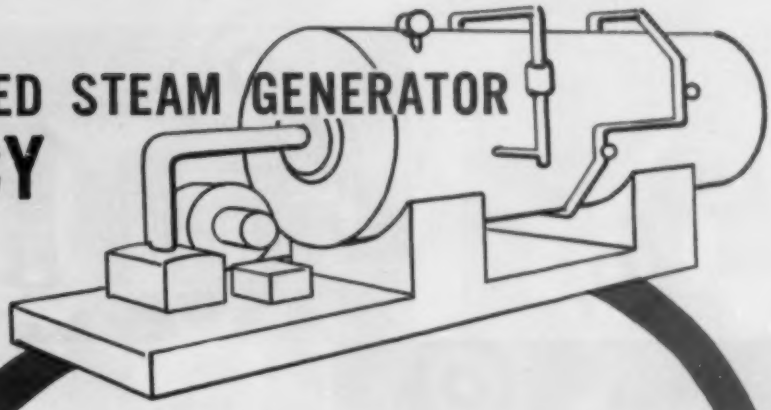
E22 Gas and liquid flow regulation is said to be improved by use of a small, pneumatically-operated control drive. Compact, it may be installed in any position on a column, pipe, or flat surface. Time required for full travel (75 deg) is adjustable. The drive has a 4 in. piston stroke at a torque of 75 ft lb. It operates on standard signal ranges 3 through 15 and 3 through 27 psig. Bailey Meter Co.

New reducing valve features exceptional accuracy

E23 Pilot-operated steam reducing valve No. 933 announced by Klipfel Valves, Inc. meets the needs of most steam reducing valve installations. It is manufactured in sizes from ¼ to 6 in. Sizes below 2 in. have bronze bodies; larger sizes are semi-steel. Stainless steel discs and seats are used in sizes 4 in. and smaller; 5 and 6 in.

Ideal Combination

FOR TOP SELF-CONTAINED STEAM GENERATOR EFFICIENCY



1

Nalco WATER TREATMENT
SCALE AND CORROSION PREVENTION

With a Nalco Service Policy and Nalco Chemicals to fit your water treatment requirements, you can keep your self-contained boilers operating indefinitely at top efficiency — without any of the costly difficulties caused by scale and corrosion. This part of the Nalco System was designed expressly to provide small boiler users with the same complete water treatment services enjoyed by thousands of the country's largest power plants. A new 4-page bulletin gives complete details on The Nalco System as applied to the modern self-contained boiler. Your copy will be sent promptly, without obligation.

Write for Bulletin 49

2

Nalco SR-155 FUEL OIL ADDITIVE
FUEL SAVING . . . CLEAN BURNERS

Nalco SR-155 is a *complete* fuel oil additive. It replaces two, three or more single-purpose additives to: (1) keep storage tanks, fuel lines and burners free of sludge and gum; (2) prevent soot formation in the firebox and flues; (3) inhibit corrosion throughout the fuel system; and (4) act as a combustion catalyst to assure complete burning of oil. Fuel savings and reduced maintenance costs usually more than repay the cost of continuous SR-155 treatment — and very little SR-155 is needed per 1,000 gallons of fuel oil! Details on Nalco SR-155 will be sent on request.

Write for Bulletin 46

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM • Serving Industry through Practical Applied Science

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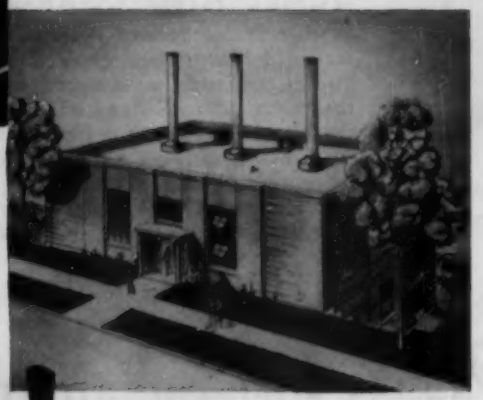
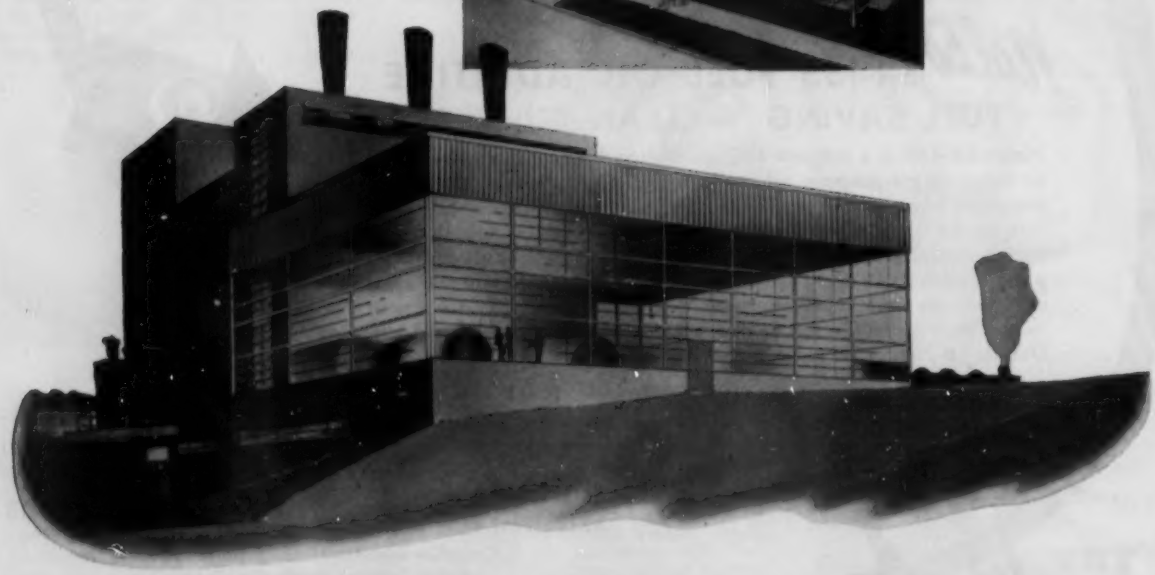
PROVED IN AMERICA'S





THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

POWERHOUSES SINCE 1854

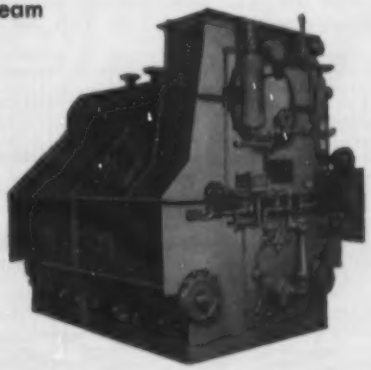
WICKES

STEAM GENERATORS

You'll find the real proof of WICKES' years of experience in the powerhouses across the nation . . . in the foundries and factories, the public utilities, the refineries and natural gasoline plants, in the schools, hospitals and other public buildings that depend on steam for low-cost heat and power. Wickes supplies steam generating equipment to thousands of industries and institutions.

WICKES will design and build water tube steam generators for any practical size and pressure. Wickes also offers a wide choice of auxiliary equipment so that it's possible for you to get not only the best steam generator but also the best correlated equipment.

Contact your nearest Wickes sales representative or write us today.



183

RECOGNIZED QUALITY SINCE 1854 • **SALES OFFICES: Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.**

Circle 509 on Reply Card for more data

new equipment

—Starts on page 8

sizes are supplied with bronze inner valves and seats, but can be furnished with stainless trim on special order. Literature is available.

Instrument measures voltage in three ranges

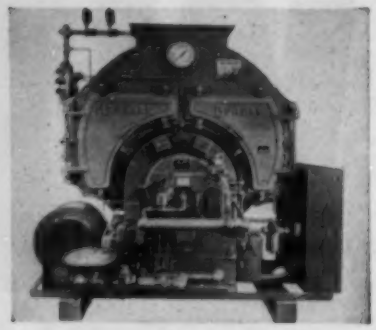
E24 Hook-on volt-ammeter AK-5 with automatic scale changing is announced by General Electric Company's Meter and Instrument Dept. The pocket-size unit is designed to measure current and voltage quickly and accurately. It has a current range of 5/20/80/350 amp and also measures a-c voltage in three ranges 150/300/750 without auxiliary equipment, is said to provide accuracy up to three percent of full scale, and withstands a voltage breakdown test of 4000 volts ac.

Cable entry is water-tight

E26 Cannon Electric Co. announces a rapid disconnect power plug and receptacle, numbers 20295-1 and 20296, for use on portable or stationary prime power sources. The fittings carry two 200-ampere contacts for number 0 cable with 110 to 440 v service. Cable entry is water-tight sealed with a screw tightened clamp. Shell is steel and synthetic rubber for both strength and resiliency. The steel parts are cadmium plated to resist corrosion, and the heavy silver plated copper alloy contacts may be removed for soldering, inspection, or replacement. Literature is available.

Adjustments possible while burner is in operation

E27 Model C-1-A, heavy-duty pressure atomizing commercial oil burner designed by the Iron Fireman Manufacturing Co. for firing CS No. 2 or lighter fuel, is available in capacities ranging from four to eight gallons per hour. Adjustments can be made while the burner is in actual operation, facilitating setting of the burner for maximum combustion efficiency and allowing the most suitable flame shape for the combustion chamber. It is equipped with a totally enclosed, permanently lubricated, ball bearing motor produced by the Electronics Div. of this company. Burners are available for use either with stack switch or electronic controls in draft tube lengths of 9, 16, or 22 in., and feature twin nozzles for improved atomization.



Companies combine talents to create boiler-burner unit

E28 Kewanee-Ross Corporation and the Ray Oil Burner Company jointly announce the new Kewanee-Ray Boiler-Burner Unit for high and low pressure steam and for hot water heating. The unit is being manufactured for high pressure steam to produce 39 to 456 certified output hp at 125 and 150 lb wp . . . and for low pressure 15 lb steam or 30 lb water in sizes to produce 1,313,000 to 15,300,000

Combined unit has wide high vacuum range

E25 As a mechanical vacuum booster pump, Model MB is specially designed to exhaust into the inlet of a single stage pump acting as a second stage or backing pump. The combined unit has a wider high vacuum range with lower power consumption than has been realized up to now by compound mechanical pumps or an oil ejector or oil booster pump.

No sealing fluid is required so that the booster acts as a positive displacement compressor to retard backstreaming of oil vapors into the vacuum system.

The first of the series to be put into production by the Kinney Manufacturing Div. of New York Air Brake Co., the Model MB 1200, is combined with a Kinney single stage 125 cu ft pump. Unit is capable of producing blank-off pressure of 0.1 micron (10 to 4 mm) McLeod gage. At high vacuum the combined unit requires about 5 hp, and at an inlet pressure of 15 mm Hg, about 15 hp (Fig. 1).

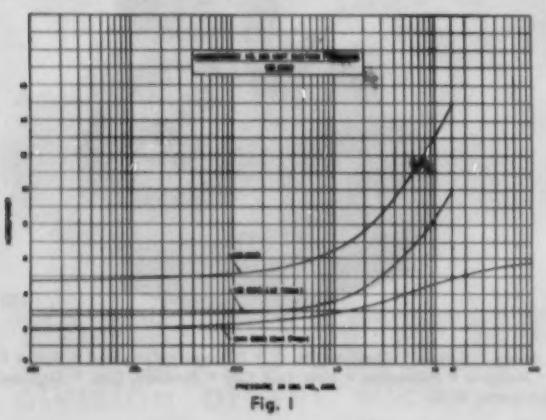


Fig. 1

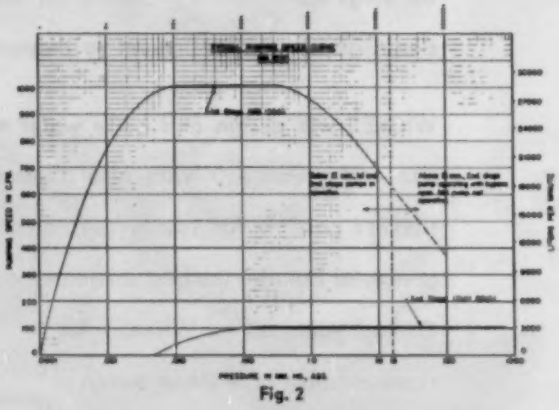
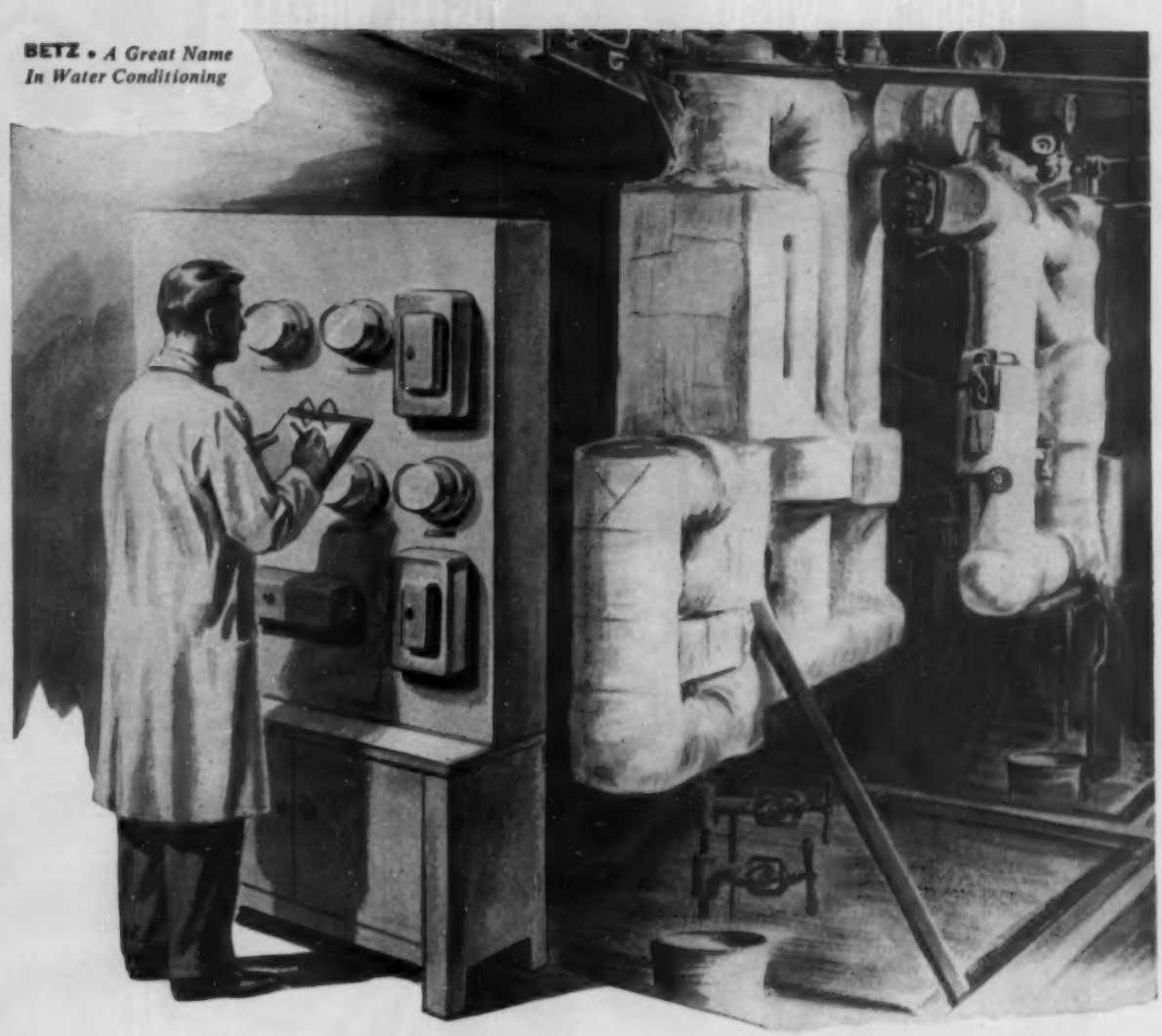


Fig. 2

As can be seen from the graph (Fig. 2), the unit has a very broad pumping speed versus pressure range compared with oil ejector (or booster) pumps.

The unit is arranged for automatic control. The MB 1200 pump, provided with built-in bypass valve, is directly connected to a 10 hp, 1800 rpm motor. The single stage pump is provided with a 5 hp, 520 rpm gear motor, both units being assembled on a common base plate.

BETZ • *A Great Name In Water Conditioning*



Proving ground for an idea

Many of today's industry-accepted water conditioning techniques were unknown just a few short years ago. Yet they were made possible by the extensive research which is carried on daily at our headquarter laboratories in Philadelphia.

Little wonder then, that we consider our *continuing* program of research and development so important.

The testing and retesting of new chemical compounds and formulations—*under actual plant conditions* in complex "Tom Thumb" equipment like this—is only a small part of our research program conducted to assure better water conditioning for industry.

As a result, advanced Betz discoveries, tested in the laboratory and *job-proved* in the field, have vastly increased operating efficiency and economy in industrial plants, petroleum installations, and institutions—everywhere.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

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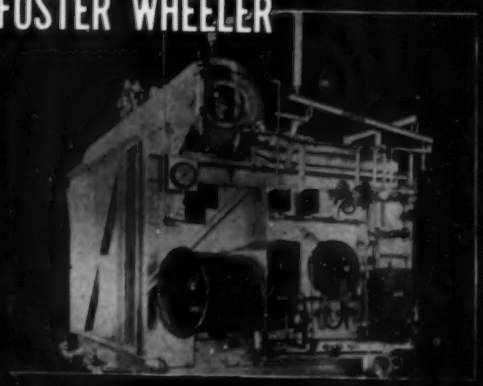
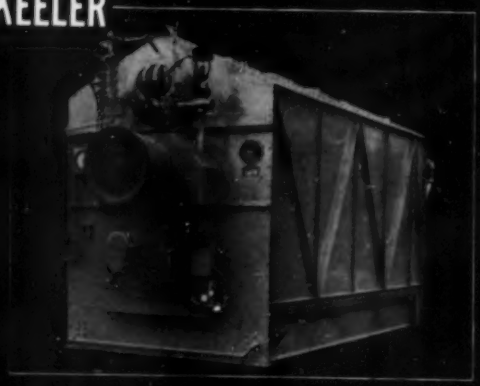
BABCOCK & WILCOX

FOSTER WHEELER

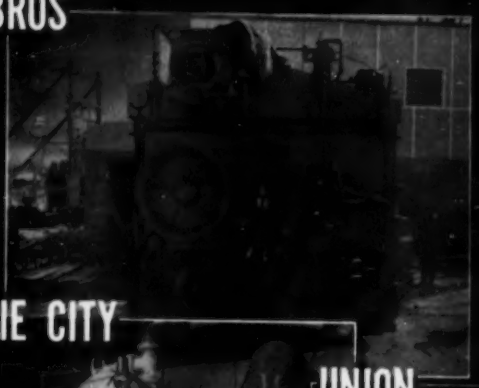


BIGELOW

KEELER

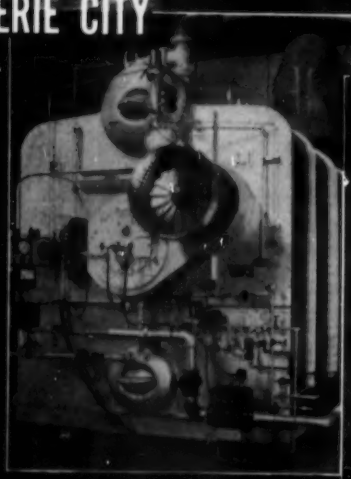


BROS

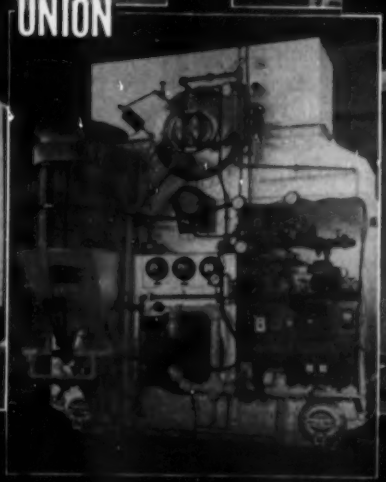


SPRINGFIELD

ERIE CITY



UNION



TITUSVILLE

WHY DO ALL THESE LEADING BOILER MAKERS USE WING FORCED DRAFT FOR THEIR PACKAGED UNITS?

HERE'S WHY:

1. **Airfoil fan blading gives top efficiencies.**
2. **Wing Voltrol Vanes give 90% capacity control.**
3. **Pre-sealed bearings lubricated for their life.**
4. **Only 8 bolts required to mount blower on windbox.**

L. J. Wing Mfg. Co. 139 Vreeland Mills Road, **Linden, N. J.**

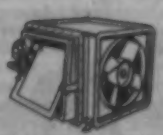
Factories: Linden, N. J. and Montreal, Can.

REVOLVING UNIT HEATERS

STRAIGHT LINE DUCT FANS

ELBOW TYPE DUCT FANS

AXIAL FLOW BLOWERS


FURNACE DRAFT INDUCERS

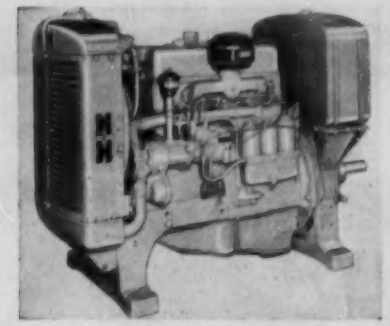
STEAM TURBINES

Circle 511 on Reply Card for more data

new equipment

—Starts on page 8

Btu hourly. It is designed for forced draft operation with a multistage secondary air control on the burner. A bulletin is available.

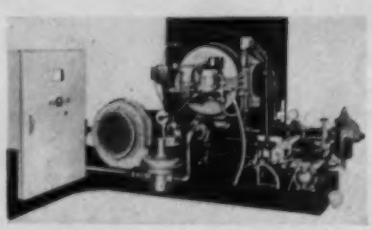


Four and six cylinder units use energy cell design

E29 Both the D283-4 four cylinder and D425-6 six cylinder diesel units available from Minneapolis-Moline Co. have a 4¼ in. bore, a 5 in. stroke, and feature energy cell combustion for reduced fuel consumption. American Bosch simplified single-plunger fuel injection system, an improved package water pump, and two water coolant nozzles for each fuel injector nozzle are featured. Three-stage fuel filter unit and large capacity oil filters are said to assure trouble-free operation.

More complete maintenance kit is available

E30 Blackhawk Mfg. Co. announces a Super Maintenance Assortment of its hydraulic "Porto-Power" equipment. Designed for industrial maintenance and construction work, this 46-piece assortment, F-Z 15, has remotely-controlled hydraulic jacks and attachments for pulling gears, moving machinery, and other maintenance jobs. It is said to conserve manpower and eliminate hazardous makeshift devices that endanger personnel and machinery.



Burners equipped with forced draft fan

E31 Packaged gas burners, oil burners, and combination gas-oil burners for commercial-industrial heating and power applications developed by Petro Division are, in each case, entirely assembled, wired, piped, and tested at the factory; components are integrally mounted on a heavy structural steel base. Gas burners range from 3,750,000 to 24,000,000 Btu input; oil burners, from 24 to 145 gph. Each unit is equipped with an enclosed electrical control panel and with a forced draft fan which will deliver necessary air against a positive furnace pressure.

TO REQUEST ADDITIONAL DATA

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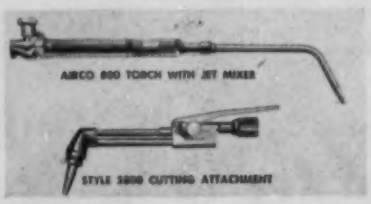


Cutting attachments and mixer extend torch range

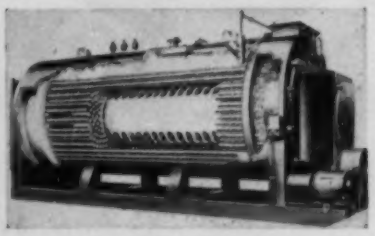
E32 New cutting attachments and jet-type mixer greatly extend the cutting, welding, and heating range of the Airco Style 800 general purpose oxyacetylene torch, according to the manufacturer Air Reduction Co., Inc. Style 1800 cutting attachment cuts steel up to 6 in. thick and the style 2800 cuts steel up to 8 in. thick. Standard Airco cutting tips may be used with the attachments. The mixer can be easily removed for cleaning or replacement, if necessary. Technical literature is available.

Mastic carries UL label

E33 Type 80 mastic, manufactured by the Benjamin Foster Co. is an anti-corrodant; a vapor barrier; a weather protective coating with "built-up film thickness," and now carries the UL label with the Fire Hazard Classification listing. Applied over large storage tanks, pipe lines, valves, and fittings, thermal insulation, and all types of structural metals, this coating should prove of interest to all engineers concerned with fire hazard in critical areas. Technical literature is available.

Fuses have high interrupting capacity

E34 Type CLF current-limiting fuses have been added to General Electric's line of 250-volt and 600 volt fuses according to an announcement by the Construction Materials Div. These fuses are one-time, cartridge-type, designed for applications where conventional NEC fuses do not have sufficient interrupting capacity. Fuses are available for 250 and 600 v ratings for 6, 15, 20, 30, 40, 60, 80, 100, 150, and 200 amp.



Two-pass boiler design eliminates refractory baffle

E35 Continental Boiler Division of Boiler Engineering and Supply Co., Inc., reports a simplification and improvement in their boiler construction. The Continental, an automatic steam generator, 20 to 500 hp, features a two-pass design which eliminates the need for refractory baffles or partition in front or at the rear. This design is reported to make possible easy and full access to all fire surfaces. Under normal operating conditions the stack temperature is guaranteed not to exceed 125 F above saturated steam temperature at the operating pressure.

High pressure valve line expanded

E36 Newest addition to the line of high pressure control valves manufactured by The Annin Company is the series 34 line for pressures to 6000 psi and temperatures to 900 F. Pictured are models 3460, Domotor

COUNT ON 25 YEARS OF ECONOMICAL SERVICE

from a

PREFERRED UNIT STEAM GENERATOR

Preferred Unit Steam Generators are available in sizes from 20 to 600 B.H.P. and pressures from 15 to 250 psi, to burn oil, gas or in combination

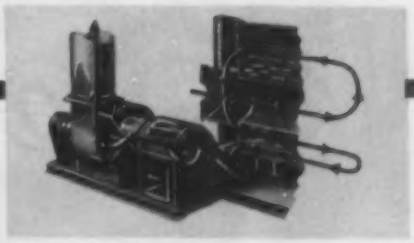
All units are factory fire-tested before shipment.

Because of the economies it realizes in low overall operating and maintenance costs, a Preferred installation pays for itself in *five years or less,* amortization included. Yet it gives 25 years expectancy of sustained high thermal efficiency (80% or more) over the entire range of load demand. Thus, four-fifths of the life of the installation costs you nothing!

10 DESIGN FEATURES ARE THE REASON

Incorporated in the Preferred Unit Steam Generator are ten design features which make possible the remarkable record of this "packaged" boiler. Other makes may have some of these features, but only the Preferred has ALL TEN. They are combined to assure lowest cost steam generation by cutting fuel consumption by 10% or more and, above all, by cutting to a minimum such maintenance costs as refractory repairs, tube cleaning and corrosion-caused replacements. Although hundreds of Preferred Generators are in daily operation, there has never been a single case of furnace loss. There has never been a single loss of a pressure vessel.

The inter-related functions of Preferred's ten design features are discussed in Bulletin 2000. You'll find it interesting and profitable to study. Write for a copy.



EXPANSILE PRECIPITATOR

Holds and contains entrained non-combustibles and insures clean, smokeless operation. It makes possible the maintenance of maximum gas velocities in all tubes at all times by preventing the build up of deposits, particularly at the last pass.

The Expansile Precipitator is one of the 10 design features which insure long service life and low overall maintenance and operating costs. Here are the other nine . . .

- Five Sq. Ft. of Heating Surface per Boiler HP
- Four Pass Gas Travel
- Down Draft Design
- Induced Draft
- Intermediate Furnace Position
- Anti-Stress Deck
- Staggered Tubes
- Dual Purging Action
- Full Automatic Oil and/or Gas Burners

PREFERRED UTILITIES MFG. CORP.

1860 BROADWAY, NEW YORK 23, N. Y.

Department SP-3

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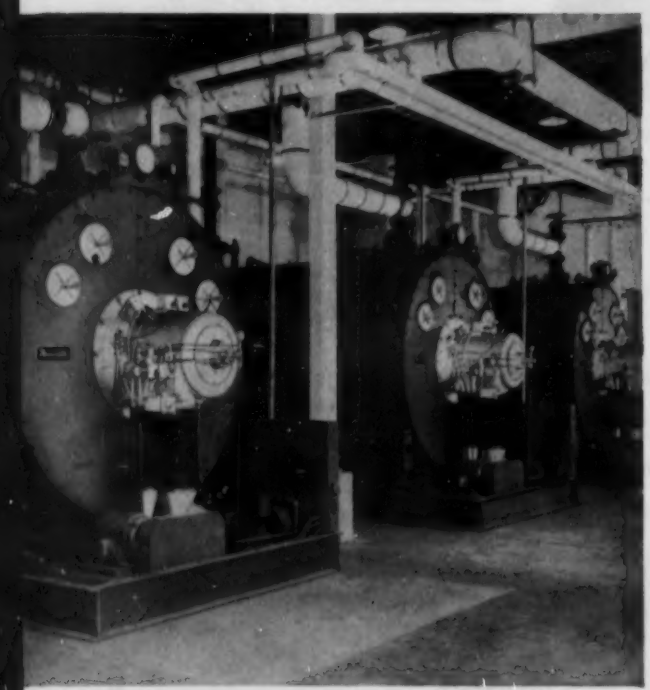
New.. Powermaster®

exclusive....

Now . . . for the *first time* you can get packaged boiler units in the wide range of capacities from 15 to 500 HP, with *complete interchangeability of fuels* . . . light or heavy fuel oil—natural or manufactured gas—or combination gas and oil . . . and you get this cost-saving advantage *only* with *Powermaster* Packaged Automatic Boilers. Find out more about this new, wide-range service today from your *Powermaster* representative. He will help you with recommendations and suggestions for selecting the most economical units to supply steam or hot water requirements in any kind of service—industrial plants, institutions, public buildings, schools, laundries, apartment houses, hospitals, dairies, motels, and shopping centers.



Model 3 *Powermaster*—Experienced-proved to be the standard of industry. These three 350 HP units are supplying process steam at pressures up to 200 psi. with rapid response to load changes.

- Complete Fuel Flexibility:
  Light or Heavy Oil, Any Gas or Combination Oil and Gas.
- Choice of:
  Air Atomizing VORIFLOW Oil Burner —Pre-Mix VORIFLOW Gas Burner— Combination VORIFLOW Oil and Gas Burner—All Designed and Built by O & S.
- Full-Range Modulation with VORIFLOW Combustion.
- All Middle-Range and Large Capacities.
- Selection of Automatic Operating and Safety Controls.
- Instant Change from Fuel to Fuel.

Send for bulletins describing Model 3 and Model 4 *Powermaster* units.

ORR & SEMBOWER, INC.

READING, PA.

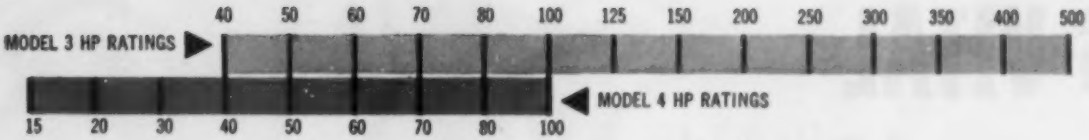
BUILDING DEPENDABLE BOILERS SINCE 1885

Circle 513 on Reply Card for more data

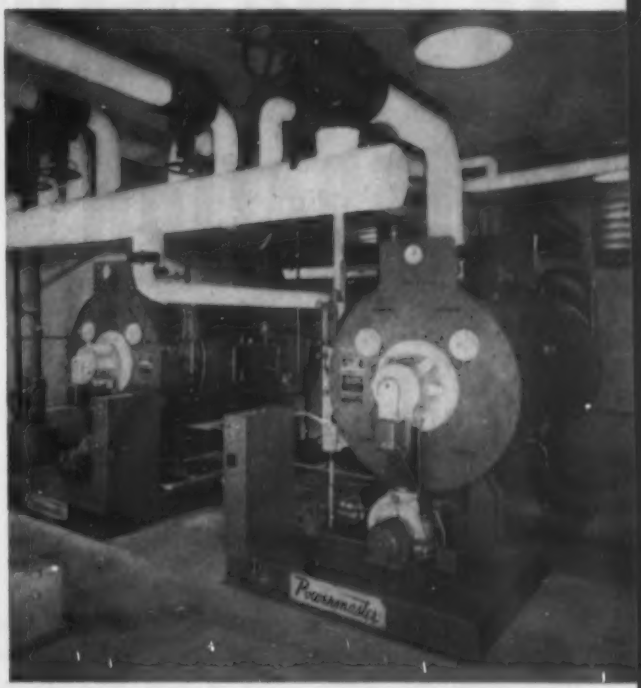
. . . a choice of 2

Powermaster Packaged Automatic Boilers to meet your specific operating requirements . . . to your best advantage.

for 15 to 250 psi. steam or hot water



Model 4 *Powermaster*—Service-proved in wide variety of successful applications. These 40 HP units supply 15 psi. steam for heating. Simplicity of operation and controls is an important advantage.

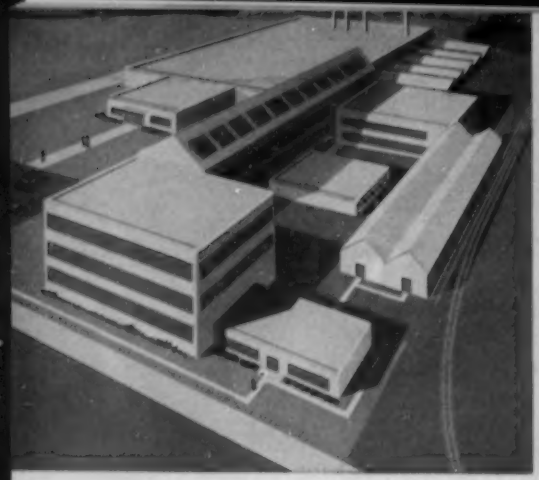


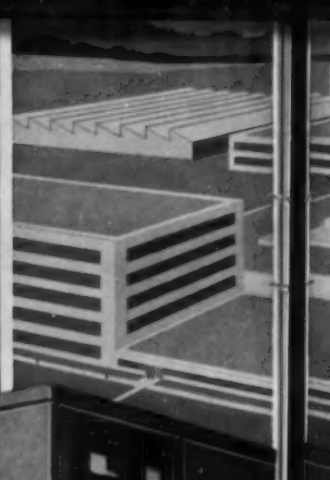
- Choice of Fuels:
  Light Distillate—Natural Gas—Manufactured Gas—Combination Oil and Gas.
- Choice of:
  Mechanical Pressure Atomizing Oil Burner—Pre-Mix Gas Burner—Combination Oil and Gas Burner—All Designed and Built by O & S.
- Simple On-Off and Low-Fire Start Burners.
- Small and Popular Middle-Range Capacities.
- Selection of Automatic Operating and Safety Controls.
- Quick Change from Fuel to Fuel.

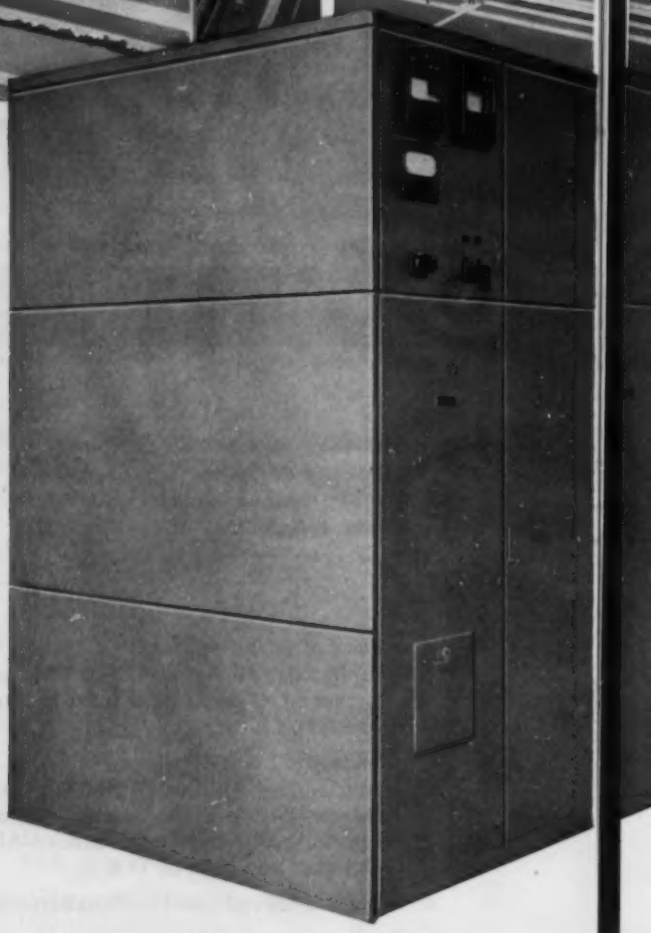
O&S

Powermaster®

PACKAGED AUTOMATIC BOILERS



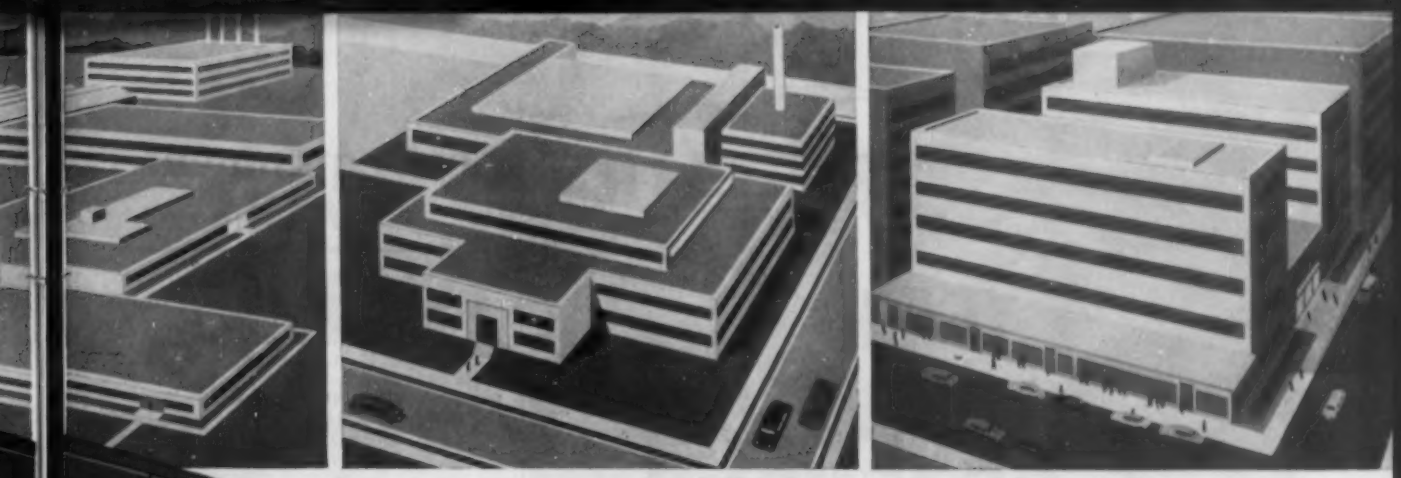


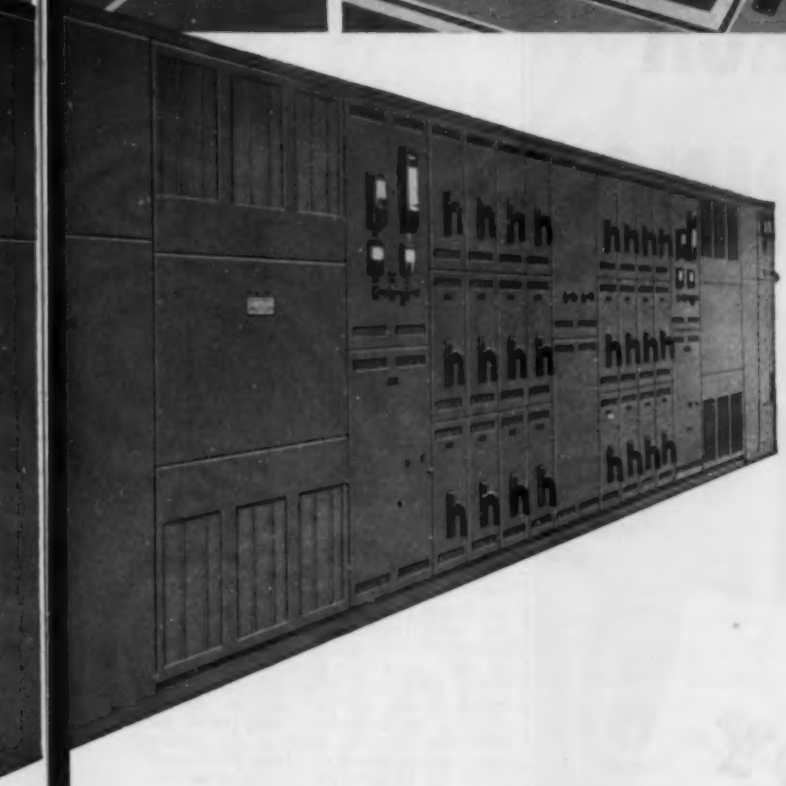


AS VITAL AS YOUR PLANT'S FOUNDATION

unit substations are basic plant investments

In central stations, industrial plants, or buildings—engineering management recognizes the need for power distribution equipment which is safe, dependable, economical, and adaptable. To Unit Substations, forming the *nerve centers* of any distribution system, is delegated the important responsibility of providing continuous power and circuit protection for years to come. Unit Substations, therefore, should not be merely *adequate*, but they must have quality to be a sound, *profitable* capital investment.





I-T-E offers a complete line of quality unit substation equipment

Through the years, I-T-E has led in the development and manufacture of quality circuit breakers and switchgear. Similarly, since the inception of the Unit Substation, and its use in modern distribution systems, I-T-E has continued to hold this same envied position. Today, I-T-E supplies a full line of quality Unit Substations, in types and sizes to fit every application.

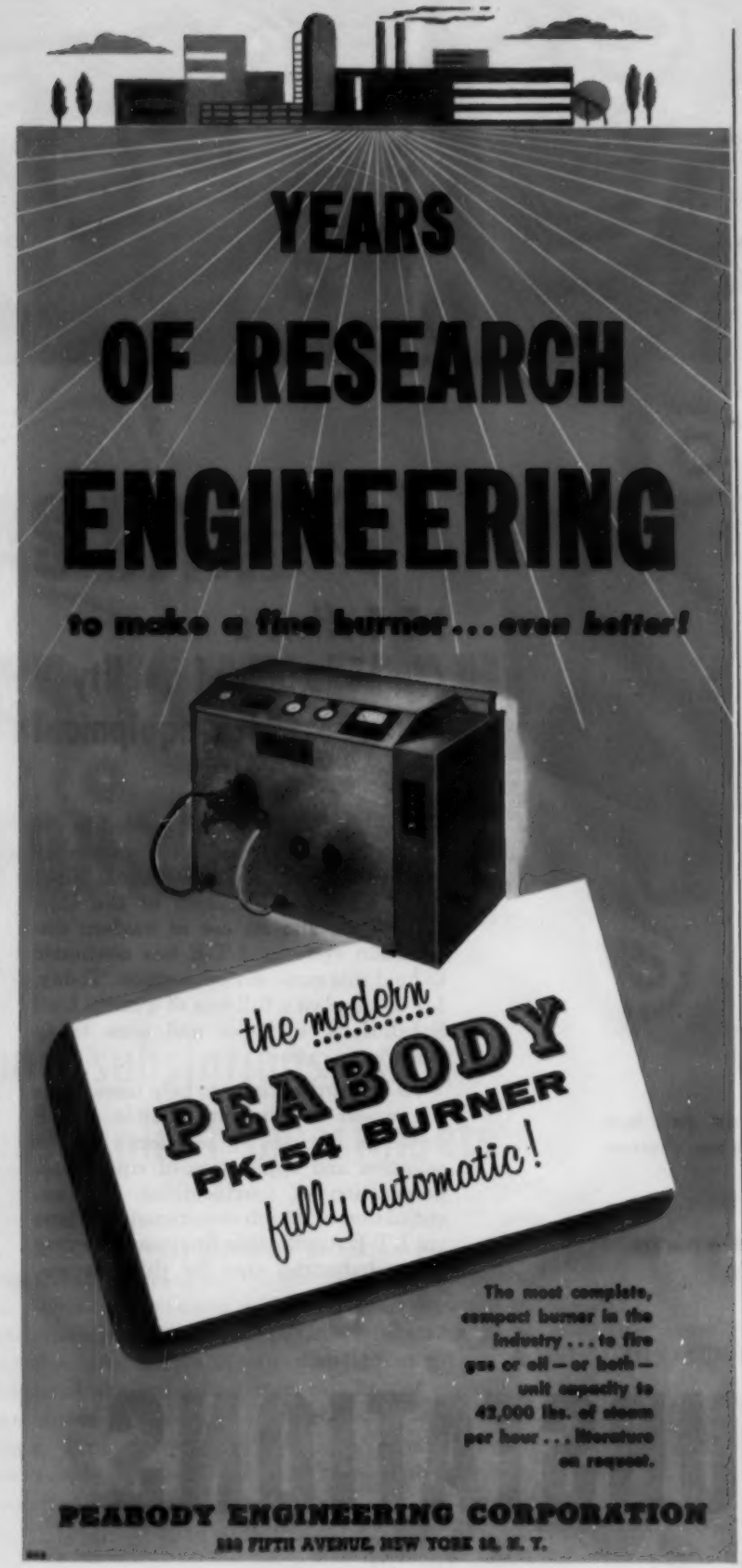
As an *extra service*—to help users make the wisest investment possible—I-T-E furnishes engineering assistance in the selection and application of equipment, preparation of specifications, and coordination of all job requirements. There are I-T-E Application Engineers in every major industrial area for this purpose.

To find the I-T-E field office nearest you, look in the classified section of your telephone directory under "Electrical Equipment."

I-T-E Circuit Breaker Co., 19th and Hamilton Sts. Philadelphia 30, Pa.

UNIT SUBSTATIONS

Circle 514 on Reply Card for more data


YEARS
OF RESEARCH
ENGINEERING
to make a fine burner... even better!
the modern
PEABODY
PK-54 BURNER
fully automatic!
The most complete, compact burner in the industry... to fire gas or oil—or both—unit capacity to 42,000 lbs. of steam per hour... literature on request.
PEABODY ENGINEERING CORPORATION
SIX FIFTH AVENUE, NEW YORK 19, N. Y.

Circle 515 on Reply Card for more data

new equipment

—Starts on page 8

operated, and 3420, cylinder operated, valves. Also available is model 34 manually operated. Valves are furnished in sizes ½ and ¼ in. in a wide selection of body and trim materials, in both offset globe and angle bodies.

Switches for heavy-duty precision service

E37 Two-circuit heavy-duty limit switches and two-circuit basic switches are being introduced by Micro Switch, a division of Minneapolis-Honeywell Regulator Co. The heavy-duty switch, catalog listing 101ML1, combines precision, two-circuit switching with rugged construction and is electrically rated for 10 amp 110, 220, or 440 v ac with a pilot duty rating of 6 amp 125 v ac. The two-circuit double-break basic switch, catalog listing 1TB1-1, is particularly well suited for reversing circuit applications where space is at a premium. It is electrically rated for 10 amp 125 or 250 v ac and 10 amp 30 v dc, inductive.

Extinguisher approved for class C and B fires

E38 Two quart capacity stored air pressure vaporizing liquid fire extinguisher of modern design introduced by Pyrene Manufacturing Co.

How MOGUL Helps You Make Sure of Efficient, Economical Water Treatment...

When you use Mogul you get the free use of a compact, easy-to-use Mogul Water Test Set. After a brief instruction by your Mogul Man you can easily make a complete, accurate water test in about five minutes. It's easy to set up a day-to-day water control which, with your Mogul Man's regular inspections, assures improved efficiency and reduced cost.

You *know* you are getting the best results possible when you use Mogul Products combined with Mogul Service and your own regular tests with the Mogul Water Test Set.

The Mogul Man in your area is glad to survey your water problem and make recommendations for corrective water treatment. He'll show you how easy the Mogul Water Test Set is to use too.

Mail the attached coupon today . . . there is no obligation.

MOGUL
Water Treatment Products

- Mogul Rust Eradicator
- Mogul Ever Clean Boiler Process
- Mogul Anti-Foam
- Mogul Amine
- Mogul Algicide

Other Products

- Mogul Flue and Chimney Clean
- Mogul Fuel Oil Treatment
- Horneblende Compound

The North American

MOGUL

Products Company

Cleveland 13, Ohio

The North American Mogul Products Company, Cleveland 13, Ohio

Send latest bulletin "Wherever Water Flows"

MR. _____

TITLE _____

COMPANY _____

ADDRESS _____

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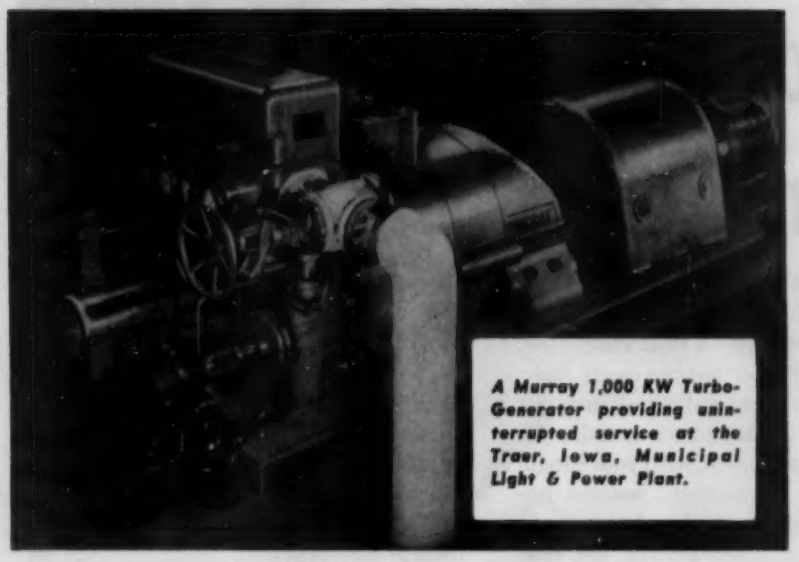
Murray Turbines



A Murray 1,000 KW Turbo-Generator providing uninterrupted service at the Traer, Iowa, Municipal Light & Power Plant.

● A typical, modern, small public utility is the Municipal Light and Power Plant at Traer, Iowa. This plant supplies water, steam heat and electric power to the community and surrounding countryside. The Murray turbo-generator pictured above carries the full electrical load of the plant and supplies the steam for heating by automatic extraction at 10# gauge pressure.

The simplified design and rugged construction of this and all MURRAY turbines particularly adapt them to this or any other drive where long life, reliability and low operating costs are a ***must.***

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

Circle 517 on Reply Card for more data

new equipment

—Starts on page 8

has a new combination carrying handle and squeeze-type operating valve that is center balanced for easy manipulation. The 30 ft hose stream is effective on Class C (electrical) and Class B (flammable liquid) fires. It may be recharged at once by refilling with Pyrene liquid and pressurizing from an air hose.

Wheels take hard tool steels in stride

E39 Vitrified grinding wheels of a special composition aluminum oxide abrasive take hard tool steels and other extremely abrasive resistant materials in stride, according to Electro Refractories & Abrasives Corp. The abrasive cuts high carbon-vanadium-cobalt type steel ¼ in. deep and ½ in. wide in only two minutes, feeding five to ten thousandths at a pass and operated at 3500 rpm dry.

TO REQUEST ADDITIONAL DATA

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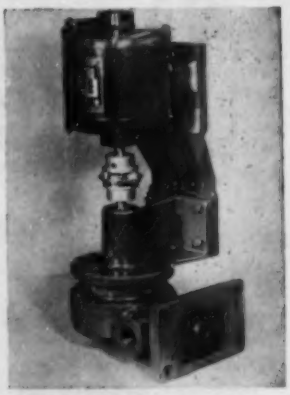


Pumps feature optional third outlet

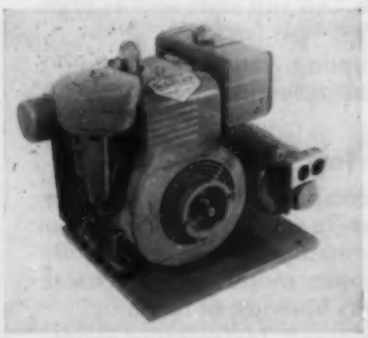
E40 Improved design of two basic models of seal-type centrifugal pumps featuring an optional third outlet back through the intake port which eliminates external piping is announced by Pioneer Pump Div. of Detroit Harvester Co. Adaptable to both continuous and intermittent pumping operations in numerous industries, the pumps are said to handle practically all types of liquids not too viscous or too corrosive for modern corrosion resistant alloys.

Lighting wires transmit code impulses

E41 IBM's Coded Signal Receiver is designed to extend the automatic operation of signals, relays, and other electromechanical devices in remote locations according to pre-selected programs. These receivers are controlled by code pulses transmitted over regular ac lighting wires when used with an International Business Machines Corp. Electronic Time and Program Control System and by electrical impulses when used with wired time systems.

Package burner fully automatic

E42 Sized for capacities to 42,000 lb steam per hr, the PK-54 burner, manufactured by the Peabody Engineering Corp., is a factory assembled unit combustion system for fully automatic operation. Each unit is engineered to meet a specific combustion problem. Various combinations for standard fuels and controls are available such as for oil only, gas only, oil and gas, and for fully automatic, semi-automatic, or manual operation. A bulletin gives further information.



Unit provides electrical and mechanical power

E43 Model B-2000 Lynnco Powerhouse, hand-portable, engine-driven, electric generator plant offers more power in less space at lower cost with greater versatility than any conventional unit in its power range, according to the manufacturer, Lynn Engineering & Supply Co. Unit will provide both electrical and mechanical

HOFFMAN STEAM TRAPS

FOR LOW, MEDIUM and HIGH PRESSURES

LOW PRESSURE TRAPS

MEDIUM PRESSURE

HIGH PRESSURE

Thermostat diaphragms are of a special alloy which will not soften or crack from repeated flexings.

Removable thermal units are a distinguishing feature of Hoffman Traps, greatly simplifying clean-out and inspection work.

Hoffman offers a complete line of Low, Medium and High Pressure Thermostatic Traps with uniform guarantee of quality and precision workmanship. A full range of sizes and capacities assures you the correct trap for service with radiation, dryers, sterilizers, mangles, cookers and similar uses. Body, cap, nut and tail piece are of high quality brass. Other features of design contribute to long life, low maintenance cost Hoffman service.

STEAM

Circle 518 on Reply Card for more data

Now!...

An INTERRUPTING RATING in EXCESS of 100,000 AMPERES *for every set of fuse clips in your plant* . . . simply by installing FUSETRON *dual-element* FUSES

The Biggest Electrical Protection NEWS Since BUSS invented the FUSETRON Dual-Element FUSE

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

In 1947 tests made by the Electrical Testing Laboratories of New York, showed that on a circuit set to deliver 50,000 amperes, FUSETRON fuses in all tests cleared the circuit safely.

50,000 amp. Interrupting Capacity in 1947
becomes
100,000 amp. Interrupting Capacity Today

After years of intensive development work on FUSETRON fuses new tests were conducted under conditions that simulated the most severe field conditions and these tests were witnessed and verified by the Electrical Testing Laboratories of New York.

On circuits set to deliver in excess of 100,000 amperes, 30 to 600 ampere, 250 and 600 volt FUSETRON dual-element Fuses on each and every test cleared the circuit without belching flame or venting hot gases and with comparatively little noise.

Oscillograms of these tests interpreted by the Electrical Testing Laboratories, showed that the total available amperes including the direct current component, reached values as great as 165,000 peak amperes on 240 volt tests and as high as 212,000 peak amperes on the 535 volt tests.

This indicates that an interrupting rating of 100,000 amperes for FUSETRON dual-element fuses is a conservative one.

No interference with time-lag

In the development work to increase interrupting capacity in FUSETRON fuses it was kept in mind that the time-current characteristic must be maintained. Time-lag is of utmost importance to give proper motor and electrical protection and to eliminate needless blowing of fuses.

Remarkable results have been achieved. Interrupting capacity has been greatly increased while the time-current characteristic of FUSETRON fuses has in no way been disturbed.

Play Safe – install Fusetron Fuses throughout the entire electrical system!

Think!...

ALL THIS ADDED SAFETY *without changing a panelboard or switch... plus* 10 Point Protection of FUSETRON *dual-element* FUSES!

Maximum Safety

With FUSETRON Fuses there is no cascading of interrupting rating — no places where an excessive fault current might cause serious damage. Every FUSETRON fuse has an interrupting rating in excess of 100,000 amperes.

You don't have to worry about selecting chosen spots in which to *pay extra* for "safe" equipment. Wherever a FUSETRON fuse is installed you have safety as sure and dependable as you can buy — no matter what you pay.

No Maintenance Costs

When FUSETRON fuses have once been installed properly you can forget about them. They need no periodic inspections to see if they will operate safely.

Dust, fumes, corrosion or age cannot prevent a FUSETRON fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

With FUSETRON fuses — you get safety — without one cent spent for inspection or maintenance costs.

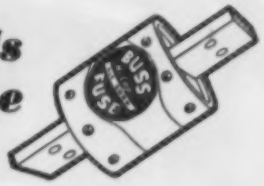
No Recalibration Costs

When a FUSETRON fuse does blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse that has been CALIBRATED AT THE FACTORY BY ENGINEERS— a fuse that is as safe and dependable as the one that blew.

PLUS 10 POINT Protection with FUSETRON dual-element FUSES

1 Protect against short-circuits. **2** Protect against needless blows caused by harmless overloads. **3** Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation. **4** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5** Protect motors against burnout from overloading. **6** Protect motors against burnout due to single phasing. **7** Give DOUBLE burnout protection to large motors — without extra cost. **8** Make protection of small motors simple and inexpensive. **9** Protect against waste of space and money — permit use of proper size switches and panels. **10** Protect coils, transformers and solenoids against burnout.

for SAFE PROTECTION on loads above 600 and up to 5000 Ampere install BUSS Hi-Cap FUSES



Tests have shown that BUSS Hi-Cap fuses have unlimited interrupting capacity on circuits of 600 volts or less.

They are designed to give protection against dangerous overloads as well as high fault currents — yet their speed of operation on heavy shorts limits currents to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

When coordinated properly with FUSETRON dual-element fuses they will not open ahead of the fuses nearest to the fault. Thus trouble is isolated to the part of the circuit in which the fault occurs.

Added SAFETY on Old Installations

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of a bad fault.

ACTION THAT SAVES YOU MONEY

By passing the word along that all purchase and stock records should call for FUSETRON fuses on loads up to 600 amps—and BUSS Hi-Cap fuses on loads above that — you get action that begets money saving.

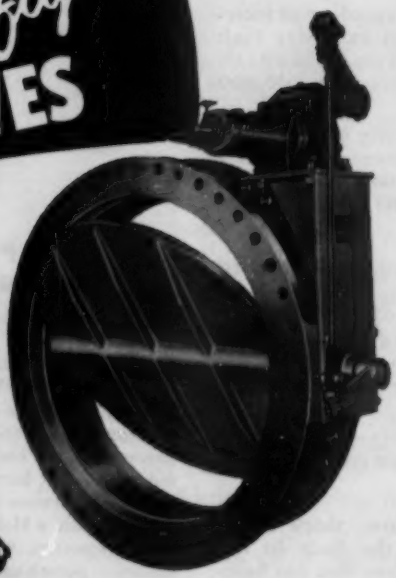
For blowing time charts or more information on FUSETRON Fuses and BUSS Hi-Cap Fuses write for Bulletins FIS and HCS.

Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. Division McGraw Electric Company

Circle 519 on Reply Card for more data

Get Positive Control and Safety

with W. S. ROCKWELL Butterfly VALVES



A 54" cast iron butterfly valve with stainless steel blade for low pressure air; equipped with crank type cylinder operator; installed in public utility plant.

Three-way valve made with 24" and 14" butterfly valves mounted on a "tee"; linked so as to close one valve when the other opens; operated by spring-loaded hydraulic cylinder; for air and exhaust gases to 60 p.s.i. and 350° F.

Rockwell Butterfly Valves are made of any required metal or rubber-lined for minimum pressure drop, uniform, quick control and positive shut-off—commercial, drip or air-tight. Sizes to 132"; pressures to 900 p.s.i.; temperatures to 2000° F., in standard and special types. Catalog on request.

W. S. ROCKWELL COMPANY

ROCKWELL SINCE 1888 BUILT

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2304 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

Circle 520 on Reply Card for more data

new equipment

—Starts on page 8

power (for belt-driven equipment) simultaneously without removing either the generator or engine from the steel base. The unit has a maximum output of 2500 w; continuous rating is 2000 w, 115 v, single phase, 60 cycles. Literature is available.

Cadmium plating eliminates oxidation

E44 Service entrance connectors introduced by Reliable Electric Co. are for aluminum-to-aluminum and aluminum-to-copper conductors. The bodies are extruded aluminum, cadmium plated to eliminate oxidized contact surfaces. A hex-head slotted screw makes for quick, easy connections.

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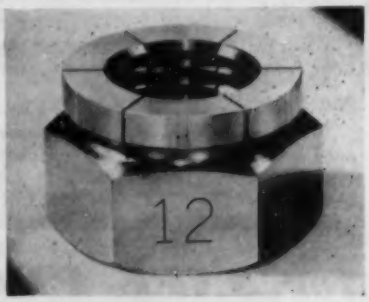

Self locking nuts for hot-spot applications

E45 To meet the critical need for high temperature fasteners in today's industrial processes, Standard Pressed Steel Co. has developed a new line of Flexloc self-locking nuts which resist temperatures up to 1200 F. Known as series 99F12, they are being made in seven standard sizes with diameters ranging from No. 10 through ⅞ in. They lock in place at any point along the bolt or stud, whether seated or not.

Coating increases pavement service life

E46 Black Top Seal, a liquid material which protects and preserves asphalt and black top surfaces has been developed by the Monroe Co., Inc. It is applied in a thin coating over new or old surface to form a

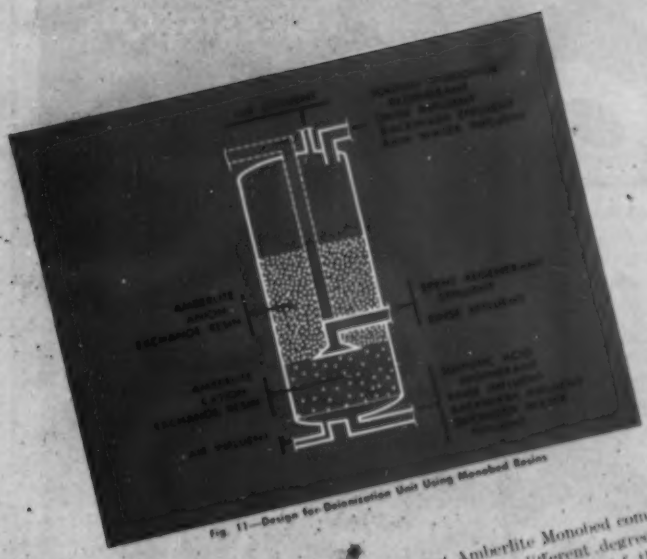

Fig. 11—Design for Deionization Unit Using Monobed Resins

... are, at present, several different Amberlite Monobed com... various functions, yielding different degrees ... discussed briefly. The choice of the ... course, is best made after ... ively to the vari... ion

Remove All Dissolved Minerals from Water Supplies... Including Silica...at Low Cost

Two major processes are available to you for removing dissolved minerals from your water supply. One system employs multiple beds of AMBERLITE ion exchange resins; the other, a single bed—MONOBED—of AMBERLITE exchangers. Either system may be varied in many ways to suit your needs. You can remove *all* dissolved minerals. You can get water with an electrical resistance of 50,000 ohms-centimeters or 5,000,000 ohms-centimeters.

Regardless of which system you choose, you can cut costs over older evaporative methods, save time, be assured of consistently high quality water.

New Book Discusses Treatment of Water by the AMBERLITE Ion Exchange Resins

If you use water, you will be interested in obtaining a copy of *If You Use Water*, a 24-page book on the treatment of water by AMBERLITE ion exchange resins. A request to Rohm & Haas Company will bring you this publication, which contains information not only on silica removal and deionization, but on softening, dealkalization, and many other aspects of water conditioning.

Write for your free copy of this book today

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

AMBERLITE and MONOBED are trademarks, Reg. U.S. Pat. Off. and in principal foreign countries.

ROHM & HAAS COMPANY
Washington Square, Philadelphia 5, Pa.

Please send me a copy of "If You Use Water ..."

Name_____

Title_____

Address_____

City_____ State_____
(zone)

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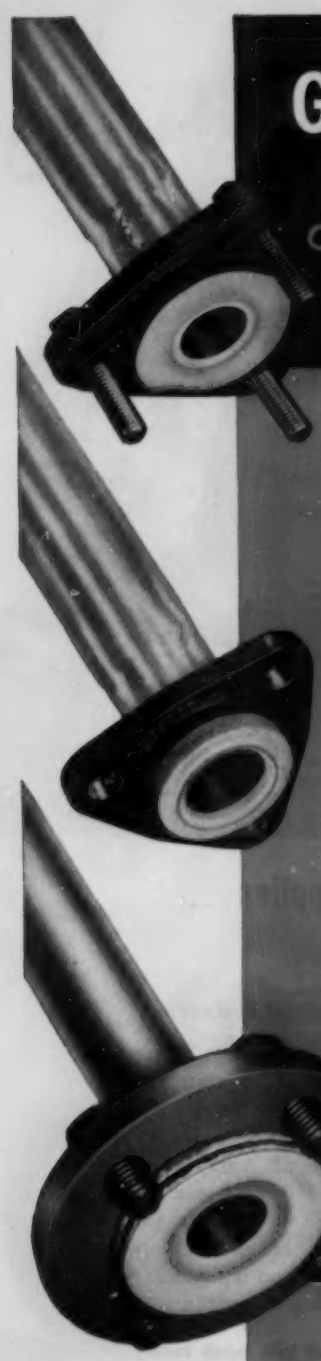

GASKETS MADE OF TEFLON FOR CHEMICAL-RESISTANT SERVICE

- Chemiseal TEFLON-Jacketed Gaskets with various types of fillers for stainless steel, glass-lined steel and conical-flanged glass pipe. Available for all standard size pipe flanges. Seal at low bolt loads.
- Chemiseal molded TEFLON Snap-on Gaskets match contour of conical-end glass pipe, assure perfect automatic centering of joints and free flow of materials. For all standard pipe sizes from ¼ in. to 6 in.
- Chemiseal TEFLON-Jacketed Adaptors provide a tight, safe seal between conical-end glass pipe, glass-coated steel or similar nozzles of large inside radii and vessels of glass-lined steel, porcelain, Haveg, etc. Easy to handle, single units, combining a steel bearing ring for rigidity and a resilient core for perfect seal, contained in a chemically inert TEFLON Jacket.

Write for Bulletin TG-953, or ask your Industrial Distributor.

UNITED STATES GASKET COMPANY

CAMDEN 1 • NEW JERSEY

FABRICATORS OF duPont TEFLON, Kellogg KEL-F AND OTHER PLASTICS

Representatives in Principal Cities Throughout the World

Circle 512 on Reply Card for more data

new equipment

—Starts on page 8

smooth, tough, waterproof surface which protects against abrasion, frost damage, blisters, and deterioration. Impervious to oil, grease, and gasoline, it is said to at least double the effective service life of bituminous pavements. Literature available.

Heater maintains constant flow of water

E47 Basic feature of the water heater introduced by Clayton Manufacturing Co. is its high velocity forced recirculating system, by means of which a constant flow of water is maintained from the storage tank through the heating coil. This system is said to sustain a uniform temperature and allows the greatest possible heat transfer. Water may be delivered at two separate temperatures simultaneously, as selected. It is available, gas or oil fired, with heating coils of either copper or steel. The self-contained, fully automatic unit, is ready for operation upon making fuel, water, and electrical connections. Detailed technical literature is available.

TO REQUEST ADDITIONAL DATA

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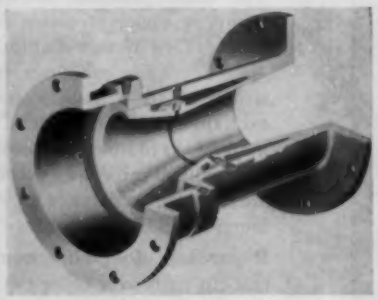
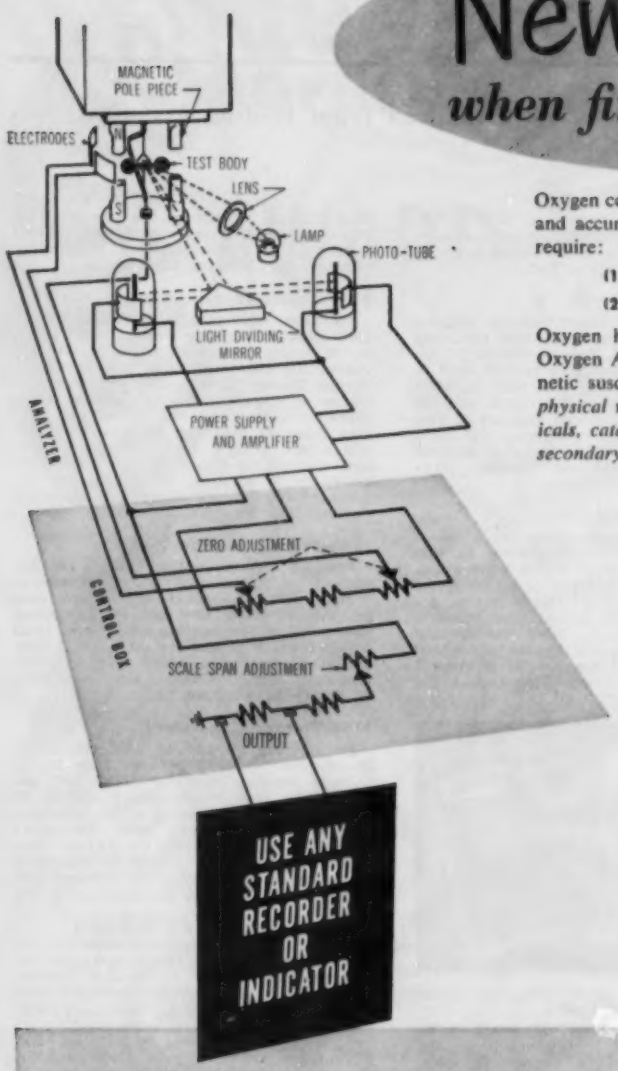


Flow tube features low permanent head loss

E48 Dall Flow Tube for metering liquids and gases is designed by Builders-Providence, Inc., Div. of B-I-F Industries, Inc. for use with gases and liquids carrying no settleable solids. Features include: very low permanent head loss, short length and low weight to provide for easy installation; Meehanite Iron body; corrosion resistant bronze liner; minimum maintenance provided by unobstructed flow path, precision machined bronze throat liner; and low cost resulting from compact design.

New Savings...
when firing with any fuel!



Oxygen content of the flue gases is generally recognized as the most direct and accurate index of correct air-fuel ratio. Optimum results, however, require:

(1) An Analyzer that is accurate, dependable, field-proven.

(2) A Sampling System that is simple, responsive, trouble-free.

Oxygen has a high magnetic susceptibility. The Arnold O. Beckman Oxygen Analyzer is the ONLY oxygen analyzer that measures total magnetic susceptibility directly. It is the ONLY Analyzer providing a *direct physical* measurement of the oxygen content itself. *No filaments, chemicals, catalysts, glassware or other complications found in conventional secondary methods of measurement are required!*

As shown at left, a small dumbbell is suspended in a magnetic field. The sample gas surrounds this dumbbell. If the sample gas contains oxygen, it is drawn into the magnetic field, causing the dumbbell to rotate into or out of the magnetic field, *depending directly upon oxygen content of the gas itself.* A beam of light, reflected by a mirror attached to this dumbbell, actuates phototubes. With simple electrical circuits, the dumbbell is repositioned to its null point by a voltage. This voltage is proportional to the oxygen content and can operate any standard recorder or indicator. *It's as simple and positive as that!*

This revolutionary Analyzer permits a completely new approach in Arnold O. Beckman Sampling Systems and accessory equipment — systems carefully engineered to meet the most difficult requirements of the power industry. They are unusually simple, trouble-free, and readily adaptable to various operating requirements.

Get the full story on this remarkable new advancement in Oxygen Analyzers. Write for Data File 10-C-54. No obligation, of course.

Features of the Beckman Model F-3

SELECTIVITY Highly sensitive to oxygen. Effects of gases other than oxygen are negligible.

MANY RANGES Combustion ranges include 0-5%, 0-10%, 0-15%, and are provided with a second range of 0-25%. Other ranges up to 0-100% O_2 are available. Calibration of the Model F-3 is strictly linear and scale is accurate over the entire range.

HIGH ACCURACY ± 1% of full scale for spans of 5% and greater. Accuracies within .05% O_2 on 0-5% range are available.

AIR CHECK Simple positive check of proper operation by recording the air point on the second range.

SIMPLE SAMPLING Independent of flow rate. Nothing is added to the sample. The sample may be dry or saturated. Corrosive gases will not poison the instrument. Only a small sample (3-15 c. in./min.) is required.

LOW MAINTENANCE Completely insulated against extreme shock and vibration. No chemicals, no catalysts to replenish. No wicks, filaments, orifices, valves, etc., to clean and replace.

STANDARD RECORDERS Any standard industrial potentiometer recorder or pneumatic receiver can be used.

Arnold O. Beckman INC.

Manufacturers of Industrial and Scientific Instruments

1020 MISSION STREET

SOUTH PASADENA, CALIFORNIA

Circle 523 on Reply Card for more data

new bulletins

. . . catalogs from leading manufacturers

200—Power Transmission

"Power Transmission Equipment," 23-page catalog 118, discusses variable speed pulleys, wide V-belts, sheaves, motor bases, countershafts, and Select-O-Speed transmission. Much more than just a catalog giving specifications, this literature presents representative applications for each unit and engineering drawings. Lovejoy Flexible Coupling Co.

201—Petroleum Products

Brief descriptions of the leading products this company produces for industrial use are given in folders A-2894 and A-2951. These products include hydraulic oils, metalworking coolants, heat transfer oils, and many others. Sun Oil Co.

202—Electronic Controls

Industrial controls, non-indicating, non-recording for regulation of simple processes which do not warrant use of the more complex and expensive instruments, are fully listed and described in 80-page catalog 8305-R. Representative applications suggest ways in which these controls may be used in your plant. Minneapolis Honeywell Regulator Co., Industrial Div.

203—Pipeline Heating

Pipeline applications of Calrod tubular heaters in industry are shown in photographs and drawings in eight-page bulletin GEA-5095A. A comprehensive chart gives heat losses of various metals. General Electric Co.

204—Vibration Problems

Actual on-the-job photos and case histories showing how representative diesel and gas engine vibration problems have been solved with effective vibration control are included in catalog PS-4. Installations featured range in size from a 16 hp diesel generator set on a truck up to a series of six 1425 hp supercharged diesels at a power plant. The Korfund Co., Inc.

205—Silent Chain

One of the most comprehensive books developed on silent chain, 88-page bulletin 2425 contains detailed engineering data. Pre-engineered stock drives for normal requirements are listed. A complete section outlines selection procedure. Complete operational and technical data, such as installation, maintenance, and lubrication procedures, are described. Link-Belt Co.

206—Low Voltage Switchgear

Bulletin 6004 A is a 24-page guide to I-T-E low voltage switchgear. Illustrated with diagrams and photographs, booklet is full of information on features, switchgear components, applications, specifications, and construction data. It also describes extra services which are available to users of switchgear. I-T-E Circuit Breaker Co.

207—Temperature Regulators

Recommended installations of temperature regulators for instantaneous water heaters, storage water heaters, and forced air heating systems are shown in three line drawings in four-page folder 1006. Cutaway diagram of a typical regulator with a description of construction is given. Spence Engineering Co., Inc.

208—Exhaust Control

How catalytic exhaust systems remove noxious carbon monoxide and irritating hydrocarbon fumes from exhausts of internal combustion engines is explained in this four-page folder. The new Dieseler exhaust which cuts smoke, odors, and CO content of 4 cycle diesel engines is also described. A graph compares CO content from equipment with and without this company's exhaust system. Oxy-Catalyst, Inc.

209—Package Feeder

Proportioning pumps and package chemical feeding units are described in this four-page folder. With liquid ends available for about 85 percent of all chemical pumping requirements, the pump is designed for use where a controlled capacity of fluid is necessary. How the feeding unit can be connected to the piping of your plant and to the electrical control equipment is explained. Bird-Archer Co.

210—Boiler-Burner Unit

The boiler-burner unit described in 16-page brochure 502 is the result of the engineering talents of these two companies. The booklet explains how the boiler and burner are designed to provide a completely automatic, ready to install unit. Multicolor drawings showing component parts and engineering data are incorporated in table form. Kewanee-Ross Corp. and Petro Div.

211—Dual Fuel Engines

In 36-page bulletin S-500-B57, are photographic examples of each application, together with vital statistics, case histories, and comments on fuel consumption for dual fuel engines. Each feature is treated separately: the dual plunger fuel injection pump; automatic fuel switcher; automatic thermal air control; and the Micrometering gas valve which accurately controls fuel gas supply to individual power cylinders. Worthington Corp.

212—Heat Exchangers

Bulletin 120 describes the operation of the Aero Heat Exchangers used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photographs. Niagara Blower Co.

213—Steam Traps

To help engineers, maintenance men, and plant operating executives select steam traps, four-page bulletin 154 discusses the construction of the Super-Silvertop Steam Trap and gives complete tables of specifications as well as pressures, weights, and list prices. Booklet also covers Steel Series Steam Traps, which are forged for higher pressures and super-heated steam service where safety is a feature, and strainers for pressure regulating valves and metering devices. The V. D. Anderson Co.

214—Woven Electric Heaters

Pre-Fab woven electric heaters are described in folder 1548 which illustrates typical uses and gives application data for this versatile heat source. Suggested uses such as for heating gearboxes, local comfort heating, and for preventing condensation are listed along with application data. Pre-Fab Heater Co., Subsidiary of Edwin L. Wiegand Co.

215—Voltage Regulators

Engineering details of this company's transformer type ⅝ percent step feeder voltage regulators (Type AFR) are described in 16-page bulletin 01B6065D. It sets forth the advantages of unit-type construction, and tells how the unit's shock-absorbing, quick-breaking tap-changing mechanism is built to withstand severe operating conditions without servicing. Allis-Chalmers Manufacturing Co.

216—Forced Draft Air Registers

Available in a number of sizes to suit specific requirements, the forced draft air registers described in seven-page bulletin 9427 are for efficient combustion when burning fuel oil, natural, refinery, or manufactured gas, and for units burning oil or gas. Operation, design features, and advantages are discussed. Combustion Equipment Div., Todd Shipyards Corp.

217—Blow-Off Valves

Catalog 12-D1 features a redesigned line of blow-off valves with flanged or welding ends and bolted bonnets for 300, 400-600, 900-1500 lb sp classes plus the addition of welded bonnet blow-off valves with welding ends for 1500 and 2500 lb sp classes. Two pages are devoted to tips on selection, operation, installation of blow-off valves and the boiler code requirements for them. Edward Valves, Inc., subsidiary of Rockwell Manufacturing Co.

218—Motor Frame Chart

To dispel any possible confusion over old and new mounting dimensions, this company has produced the "Compar-A-Frame" cluart to aid engineers and designers in quickly comparing the old and new NEMA a-c frame assignment standards. It shows at a glance comparative dimensions of open type and fan-cooled type polyphase induction motors. There

NOTE — Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 34/35 & 114/115

...keless Detroit Grate ...kers . . .

...apital City Products Co. (Columbus, Ohio)

AWARD

Certificate
OF
Merit

THE CAPITAL CITY PRODUCTS COMPANY — WEST FIRST & FRANK STREETS

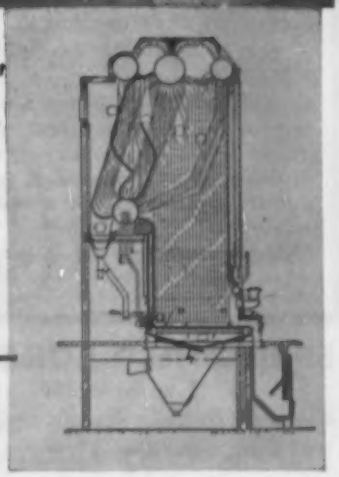
is awarded this certificate
for having operated fuel burning equipment in the
CITY OF COLUMBUS, OHIO
FOR YEAR 1952
Within limits as set forth in Ordinance 228-49
governing smoke emission

Chairman Citizens Committee

Attested by Harry C. Hallman
Chief Smoke Regulation Engineer
Division of Smoke Regulation and Inspection

Delmer J. Starkey
The Commissioner of Public Service

Detroit RotoGrate Stokers in the plant of Capital City Products Company, Columbus, Ohio.



This Detroit RotoGrate Stoker has been certified smokeless by the City of Columbus, Ohio. This certificate awarded by the Citizen's Committee, and affirmed by the Smoke Regulation and Inspection Division is proof of performance.

Detroit RotoGrate Stokers operate without smoke because of their many features of design including precise control of fuel feed, grate speed and air supply.

RotoGrate is a modern spreader stoker with grates that move slowly forward discharging the ash at the front. They burn any type of Bituminous Coal or Lignite . . . handle rapidly fluctuating loads with uniform pressure over long periods.

Have you a smoke problem? Or a problem of fuel cost? Ask for details on the RotoGrate. No obligation.

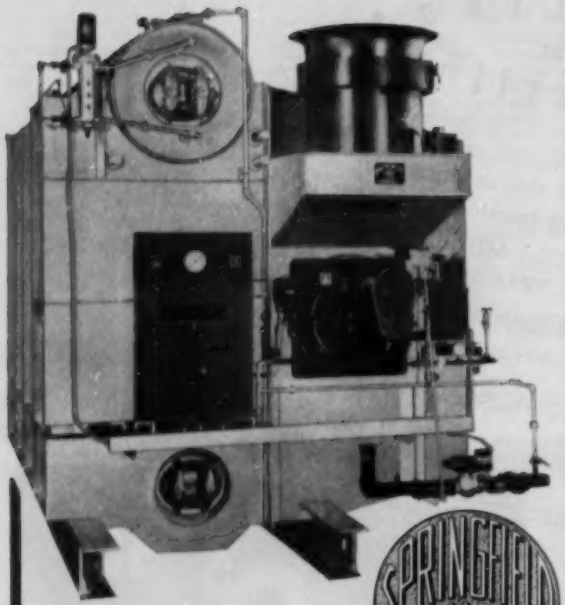
DETROIT STOKER COMPANY

General Motors Building • Detroit 2, Michigan
Works at Monroe, Michigan • District Offices in Principal Cities

Circle 524 on Reply Card for more data

Ahead in Design! SPRINGFIELD

WATER TUBE PACKAGE BOILERS



1. Rugged 2-Drum, Bent Tube *"Power Plant Type"* design. No headers, no handholes, no wasted weight. Unrestricted circulation.

2. Complete "6 wall" furnace cooling for greatest capacity. Permits higher heat release rates with lower actual "heat loading" of tubes.

3. Dry Steam — steaming tubes discharge above top drum water level.

4. Exclusive gas-tight, insulated, double-cased steel jacket. Sectional construction makes all tubes easily accessible and replaceable without necessity of tearing out and repairing side wall setting.

5. Pressurized firing. No induced draft fan or tall stack required. Indoor or outdoor installation.

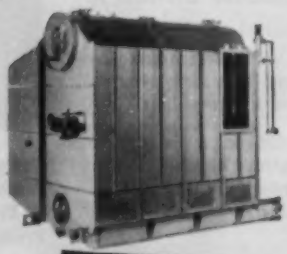
6. Efficiency — over 81% with oil. Automatic, semi-automatic, or manual control. Gas, oil, or combination firing. Underwriters' approved.

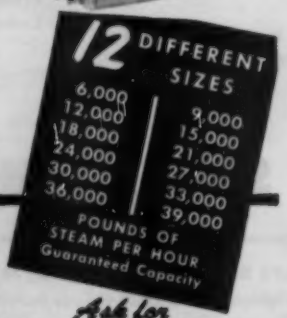
7. Widest choice of sizes. All compact, portable. Design pressures of 200, 300, 600, and 900 psig. Superheat to 200° available.

QUICKER, EASIER INSTALLATION!

When you compare quotations for package boilers, check all of the *additional values* Springfield gives you! Make sure you are getting a COMPLETE UNIT ready to connect to fuel, water, electrical, and steam lines — with *no extras* required for setting and other materials.

Springfield Package Boilers are unique in that the basic design is actually the same as a large power plant boiler — consequently, they can be built for as high as 900 psig. operating pressure. These units are also excellent for generation of high pressure — high temperature hot water. *Send for complete information.*





SPRINGFIELD BOILER CO.

Founded in 1890

A DIVISION OF *John W. Hobbs Corporation*

1967 East Capitol Avenue • Springfield, Illinois

Ask for Latest Catalog

Circle 525 on Reply Card for more data

new bulletins

—Starts on page 36

are sub-charts for comparing frame sizes according to horsepower and speed. Reliance Electric & Engineering Co.

219—Boiler Selection

What to look for when you select a boiler is explained in six-page foldout BE3 by means of a phantom drawing of an automatic boiler. Typical installations are pictured along with photographs of units for light oil, heavy oil, gas, and combination gas-oil. Continental Boiler Div., Boiler Engineering & Supply Co.

220—Diesel Engines

Handy for filing and reference purposes, a series of data sheets gives condensed information and specifications on the full line of P & H two-cycle diesel engines. Each model or engine and power unit is pictured and discussed in a separate bulletin. All models, from 20 to 138 hp, 2, 3, 4, and 6 cylinders are included. Harnischfeger Corp., Diesel Div.

221—Automatic Combustion System

How the "Thermopack" Plan meets heating and power needs of those industrial and commercial plants capable of making oil burner or oil and gas burner installations on new and existing boilers with their own maintenance crews is described in six-page foldout 185. Preferred Utilities Mfg. Corp.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 34/35 & 114/115. Your requests will be handled promptly.

222—Holdbacks

How to protect and conserve valuable conveyor belts and safeguard operating personnel with simple inexpensive accessories is explained in four-page pamphlet 651. Photographs show operation of a roller type, instant acting holdback and of a belt cleaner. Drawings illustrate typical mounting arrangements for springtype cleaners. Stephens-Adamson Mfg. Co.

223—Boiler Cleaning

Four fact filled pamphlets explain how this company's products will help you solve algae problems, increase boiler efficiency with use of the Ever Clean boiler process, remove rust, and prevent corrosion. North American Mogul Products Co.

224—Flexible Metal Hose

Engineering data and installation recommendations on three types of flexible metal hose for diesel use are given in eight-page bulletin EH-50. Corrugated steel exhaust and air-intake, steel interlocked exhaust and air-intake; braid-covered seamless corrugated for conveying air, fuel oil, lubricating oil, and water are types covered. The American Brass Co., American Metal Hose Branch.

225—Oil Filters

'Filters and Purifiers for Oil Circulating Systems,' 16-page reprint from the magazine "Lubrication" for March, 1954, discusses the contaminants encountered

Zeolite Costs Money

...why waste it?

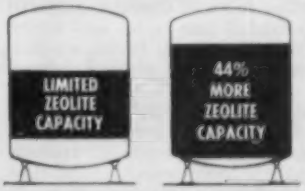
You prevent its loss when you use

... The Water Softener with the Zeolite "locked in"

Apparently the old idea in making water softeners was that the zeolite was expendable. That was an expensive idea even when zeolite cost much less . . . and of course it's still more costly today. Zeolite today represents an important part of your investment in a water softener. It isn't consumable; it's part of the capital investment . . . something to hang on to!

Loss of zeolite was stopped cold the day we introduced the "Double Check" water softener. This ingenious design truly "locks in" the zeolite. Prevention of zeolite loss during back-washing is an important feature that has become increasingly more important, *but* . . .

It's only the start of the story. Other water softeners using old-style manifolds are forced to use shallower zeolite beds to minimize escape of zeolite during backwashing. But the "Double-Check" softener can use more zeolite, and backwash it, and regenerate it, far more effectively. As a result it gives—



Up to 44% More Capacity

The diagrams tell the story. You get this extra output of soft water from the same size softener using the same type of zeolite . . . and you do it at lower operating and maintenance cost.

Sectional view of "Double-Check" Softener showing design which prevents escape of zeolite; permits deeper zeolite bed, better regeneration, greater output of soft water.

The "Double-Check" can be built into your present softener. If your existing softener is in fairly good condition you can have the advantages of zeolite loss prevention and extra capacity at surprisingly moderate cost. This type of modernization, along with our high capacity zeolite, has stepped up soft water output three to ten times in hundreds of cases.

Write today for complete information

Elgin REFINITE SINCE 1908

ELGIN-REFINITE
DIVISION OF ELGIN SOFTENER CORPORATION
138 NORTH GROVE AVENUE, ELGIN, ILLINOIS

Circle 526 on Reply Card for more data

WORTHINGTON DC-2 COMPRESSORS are installed in the Libbey-Owens-Ford Glass Company's Fiber-Glass plant in Parkersburg, West Virginia. They have five-step variable capacity controls enabling them to operate with a minimum power consumption.

Compressed air helps turn a single glass marble into 42 miles of textile filament!

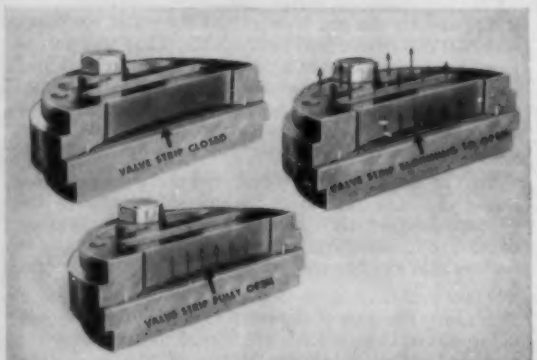
Libbey-Owens-Ford uses Worthington compressors in the manufacture of fiber glass

Daily, more than 40 million miles of filament, gathered into strands of fiber glass, twisted into yarns, and woven into industrial cloth, tape and other textile forms, are produced at the Libbey-Owens-Ford plant at Parkersburg, West Virginia.

The fiber glass filament is made by melting specially prepared glass marbles in small furnaces and drawing the glass through the minute apertures of a "bushing". Humidity is important in handling these continuous fibers of glass and compressed air is used to maintain accurate man-made weather. Compressed air is actually used in 22 important operations in making fiber glass in this ultra-modern factory.

Three Worthington DC-2 compressors, each with five-step capacity control, supply the air pressure required in these many delicate tasks.

Whatever your requirements for compressed air, Worthington builds compressors to meet them. Write us about your compressor problems. Worthington Corporation, Compressor Division, Section K.4.1, Buffalo, N.Y.



WORTHINGTON'S EXCLUSIVE FEATHER* VALVE lowers compressor fuel consumption. A series of thin flexible strips of ribbon steel lift and flex uniformly as shown. This lightest, tightest, most durable valve ever made is standard on all Worthington compressors. *Reg.U.S.Pat.Off.

K.4.1

WORTHINGTON

Only Worthington Compressors give you Feather Valve Performance

V-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

Circle 527 on Reply Card for more data

Shell Rotella Oil

Reduces piston ring and cylinder wear

Saves many dollars in costly maintenance

These dual-fuel engines in the Municipal Power Plant at Houma, Louisiana, supply dependable, low-cost electric power to the entire city. Shell Rotella Oil is the cylinder lubricant.

Here's just one of the many diesel power plants that depend on SHELL ROTELLA OIL for reduced wear of engine parts . . . lower maintenance cost.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

Circle 528 on Reply Card for more data

Demineralization and Silica Removal

CATEXER® ANEXER® PLANTS

provide the low silica, low solids boiler feed makeup water so essential to the operation of high pressure boiler and turbine operation in the plants listed below.

Good Equipment is known by the Company it keeps....

- PUBLIC SERVICE CO. OF NORTHERN ILL.
  Waukegan, Ill. (3 bed – 250 g.p.m.)
- WISCONSIN POWER AND LIGHT CO.
  Sheboygan, Wis. (2 bed – 60 g.p.m.)
- WESTERN ELECTRIC CO.
  Hawthorne Sta., Chicago, Ill. (2 bed – 200 g.p.m.)
- INTERSTATE POWER CO.
  Dubuque, Iowa (2 bed – 30 g.p.m.)
- INTERNATIONAL PAPER CO.
  Natchez, Miss. (2 bed – 900 g.p.m.)
- INTERNATIONAL PAPER CO.
  Panama City, Fla. (2 bed – 1200 g.p.m.)
- CALIFORNIA ELECTRIC CO.
  High Grove, Calif. (2 bed – 40 g.p.m.)
- NATIONAL PETROCHEMICALS CORP.
  Ficklin, Ill. (2 bed – 400 g.p.m.)
- WISCONSIN POWER AND LIGHT CO.
  North Beloit, Wis. (2 bed & mixed bed – 40 g.p.m.)

for useful information
on sodium, hydrogen or anion exchangers...
write for INFILCO Bulletin 1960 Y

INFILCO INC. | *Tucson, Arizona*

Plants in Chicago and Joliet, Illinois

Field offices in 33 principal cities in the U. S., Canada and Mexico

Circle 529 on Reply Card for more data

new bulletins

—Starts on page 36

with oils in service and the detrimental effects associated with them. Oil oxidation and extraneous matter is listed. Selection of equipment and maintenance of the various types is fully discussed and tied in with fields where oil conditioning equipment is a must such as for industrial, diesel motive, and steam turbine service. Graphs, cross-sectional drawings, and tables make this useful reference literature. The Texas Co.

226—Water Treatment

"If You Use Water," 24-page booklet IE-9, discusses the more than a dozen important water treatment processes now serving industry—variations, how they work, equipment required, and type of water produced. Advantages of various methods are interpreted in terms of application to specific industries. Rohm & Haas Co., Resinous Products Div.

227—Liquid Level Indicator

Do you have to guess at your boiler water level? Nineteen-page booklet WG 1824 describes the Yarway Remote Liquid Level Indicator and shows how it is used not only for boiler water indication but for feed water and deaerating heaters, expansion tanks, hot flow softeners, and other similar uses. Wiring diagrams show control unit uses. Yarnall-Waring Co.

228—Relief Valves

Charts, diagrams, tables, and a number of examples of plant operating conditions are presented in bulletin 5200 as illustrations to show how to correctly select a Multiport Relief Valve. It tells how the unit can be used as a differential pressure spill-over valve or as a check valve in closed steam, air, or gas systems, and also as a vacuum breaker. Cochrane Corp.

Elevator Belting

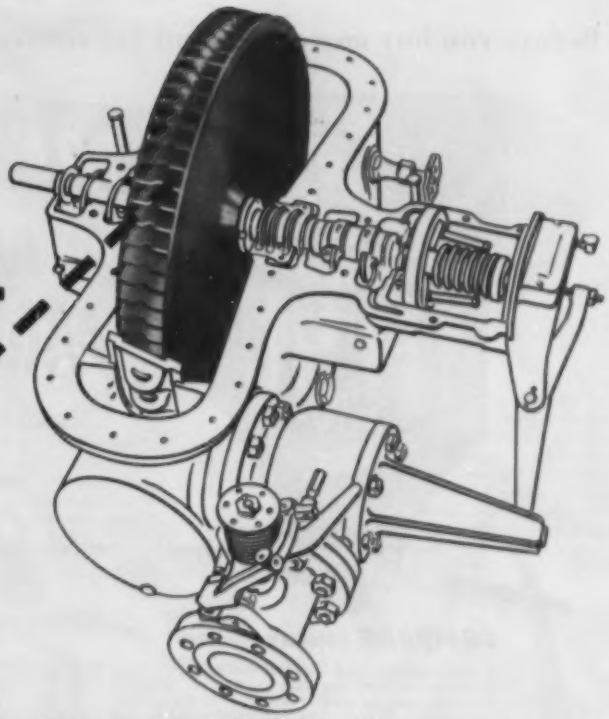
Procedures and equations necessary for engineering the correct elevator belting are given in 24-page engineering handbook S-21. Belt installation information includes bucket spacing and belt punching, minimum bucket spacing, bucket punching dimensions, tables of standard buckets, methods of belt splicing, elevator belt take-up, and pulley lagging. Data tables refer to weights of materials handled, holding properties of various fabrics, determining belt weight and thickness, and drive factors. **Please send requests directly to B. F. Goodrich Co., Akron, Ohio, Dept. IP, on your company letterhead.**

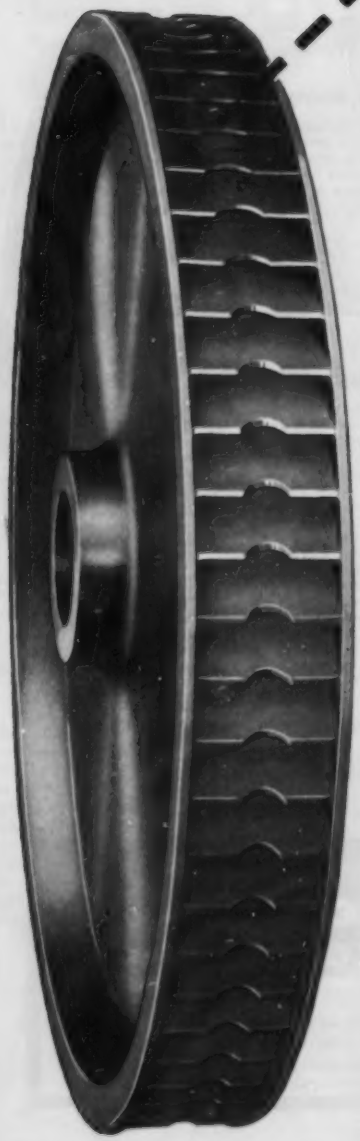
229—Automatic Lubricator

Savings in man hours and other maintenance expense have accrued to users of Model A automatic trolley conveyor lubricator according to this circular. How the unit eliminates drippage, reduces power load on drive motors, and lubricates with a measured amount of oil is explained. Moore Lubricator Co.

(Continued on page 127)

TERRY SOLID WHEEL





..."trade mark" of a trouble-free turbine

This is the rotor of a Terry solid-wheel turbine. There are a number of reasons why it has become a symbol for reliable, trouble-free operation.

First, because the wheel is a single forging, in which a series of semi-circular buckets is milled, there are no separate parts to become loose or work out.

Second, because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets, blade wear is of little consequence. Wear does not materially affect horsepower or efficiency.

Third, because the steam enters the buckets in a direction at right angles to the shaft, there is no need for close axial blade clearances. The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, the blades are double rim protected.

These are only a few of the reasons why the Terry solid wheel has become a "Trade Mark" for trouble-free turbine performance. For complete details, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1197

Circle 530 on Reply Card for more data

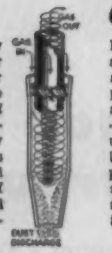
Before you buy *any* equipment for recovering fly ash . . .

COMPARE ALL OTHERS against MULTICLONE'S Multiple Advantages

Because the advantages of MULTICLONE are so clear-cut, so vitally important, so far-reaching in the savings they make, we urge you to make a factual unbiased comparison of MULTICLONE fly ash collection equipment against *any other* in the mechanical recovery field. Only by making such a comparison can you fully appreciate the major savings and greater performance you get by installing MULTICLONE Collectors!

COMPARE Recovery Efficiency!

It is a recognized fact that the separating efficiency of a cyclonic tube *increases* as the tube diameter *decreases* because smaller tubes generate greater centrifugal forces. The patented vane in the MULTICLONE makes the use of small tubes *practical* without complicated manifolding and permits compacting many small tubes into one simple, highly efficient unit. MULTICLONE's higher centrifugal forces throw out not only the large, medium and small particles, but also an unusually high percentage of the *extremely small* particles of 10 microns and less. Result—*more complete recovery of all suspended particles from the gas stream!*



COMPARE Space-Saving Compactness!

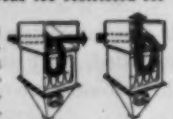
Plant space costs money—particularly at today's high construction costs. Because the MULTICLONE is more compact, size for size, it makes *really important* savings in space and plant costs. Note in the chart how the MULTICLONE requires substantially less space—*both in floor space and cubic space*—than any other unit of comparable capacity and performance. *This means vital savings in construction costs!*

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.0
Collector B	5.9	3.2
Collector C	6.6	3.9

COMPARE Dollar-Saving Adaptability!

Savings in space is just one of many ways MULTICLONE reduces installation costs. Because the shape of the unit can be readily varied (long and narrow, short and wide, or square) to fit available spaces, the MULTICLONE can often be tucked into odd corners and waste areas too restricted for other equipment.

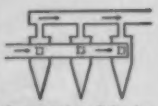
Moreover, inlet-outlet ducts can be varied—side-inlet side-outlet, or side-inlet top-outlet—to meet low headroom or restricted side clearance requirements . . . and the single-inlet single-outlet duct design permits greater flexibility and simpler installation. *These all add up to vital savings in installation costs!*



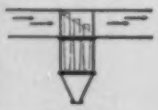
Side inlet, Side outlet ***Side inlet, Top outlet***

COMPARE All-Around Simplicity!

The MULTICLONE is simple and inexpensive to maintain because there are no highspeed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. In addition, the square, flat-sided shape of the MULTICLONE and its straight inlet and outlet ducts are far simpler to install and insulate. And since the recovered material from an entire bank of tubes is collected in a *single* hopper, it is much easier to service and maintain than the multiple hoppers of conventional cyclone units. *Here again, the MULTICLONE saves in many ways—all of them important!*

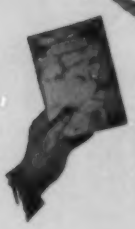


Conventional Cyclone



Multiclone

Whether your recovery installation is in a new structure or for modernizing present equipment, you will be far ahead by installing MULTICLONE Collectors. Our experienced engineers will gladly make helpful suggestions for simplifying your recovery problems. A letter, wire or call to our nearest office places this assistance at your service without obligation.



Send for Helpful Literature! This factual MULTICLONE literature explains the basic principles of cyclonic dust recovery and gives technical data helpful to anyone contemplating a dust or fly ash recovery installation. Write today for your free copy!

WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1067 WEST NINTH STREET, LOS ANGELES 13, CALIFORNIA
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Engineered for the Textile Industry

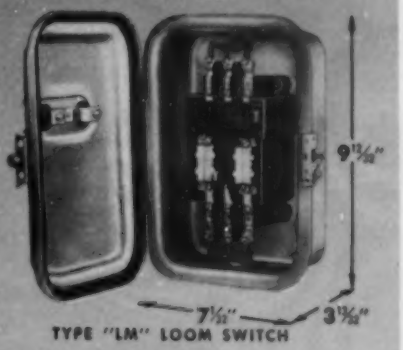
3 NEW DEVELOPMENTS IN MOTOR CONTROL

ARROW AH HART

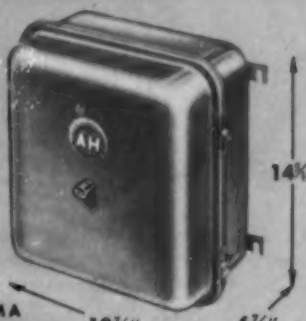
All

OFFERING THESE IMPORTANT ADVANTAGES

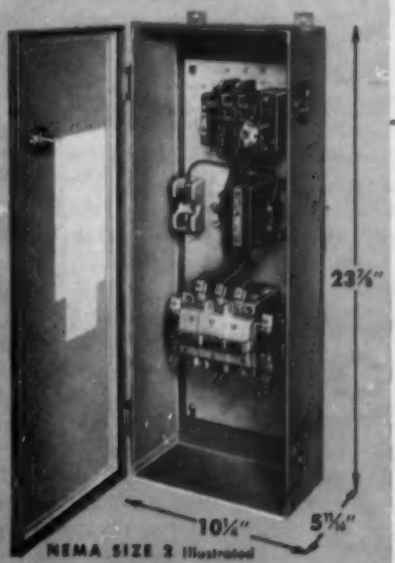
- **DOUBLE PROTECTION AGAINST LINT . . . and other breakdown materials**
- **GREATLY REDUCED FIRE HAZARD**
- **SUPERIOR PERFORMANCE and DEPENDABILITY**
- **LONGER LIFE**
- **SMALLER SIZE and WEIGHT . . . saving valuable space**
- **FASTER, EASIER INSTALLATION and MAINTENANCE**
- **SAFER, MORE CONVENIENT OPERATION**



TYPE "LM" LOOM SWITCH



NEMA SIZE 3 Illustrated



NEMA SIZE 2 Illustrated

TYPE "LM"
Loom Switch

Size 0, 3 pole, 2 hp to 600 volts a-c. Completely new, radically different . . . not just an adaptation of a standard switch. Unique, built-for-the-purpose rotary overload mechanism resists shock far in excess of any found in actual loom installations. Fully enclosed switch unit plus lint proof enclosure provides double protection against lint.

NEMA TYPE XII
Enclosure for Magnetic Starters

For starter sizes 0, 1, 2 and 3. Used wherever switch ratings exceed 2 hp . . . or remote control is desired. Enclosures with heavy neoprene gaskets protect effectively against lint. Smaller, lighter A-H Type "RA" (Right Angle) Starters provide superior performance, dependability. Vertical contacts offer added protection by preventing accumulation of breakdown material.

NEMA TYPE XII
Combination Starter

Smaller and lighter than any other combination starter of comparable rating, the "RAC" offers the advantages of the unique A-H Type "RA" Starter plus the exclusive new A-H "RAD" Disconnect *plus* the all new A-H enclosure that provides full protection against lint and other breakdown materials. Available in Sizes 0, 1 and 2 with fused or unfused disconnect or with circuit breaker.

The Arrow-Hart Controls shown have been designed and constructed throughout specifically for the operating conditions peculiar to the textile industry. Standards for safety, performance and ease of installation and maintenance were determined, met and exceeded in all these Arrow-Hart Motor Controls. Be sure to request a copy of "Electrical Controls for the Textile Industry" . . . complete with product, application and engineering data.

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Your Folder Will Be Mailed Promptly

INDUSTRIAL CONTROL DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO.

103 HAWTHORN ST., HARTFORD 6, CONN.

Please send my free copy of "Electrical Controls for the Textile Industry."

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ZONE_____ STATE_____

IP-5

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What it takes to make a 3000 Degree Refractory Concrete

Because of the widespread interest in the use of refractory castables, many furnace operators have asked us for the story behind the performance of B&W's unique refractory concrete, Kaocast.

Here are the answers to some of the most frequently asked questions:

Q. *When you refer to Kaocast as a 3000 degree refractory castable, do you mean that its melting point is 3000° F?*

A. No, this means that its service use limit is 3000° F; its melting point is 200 degrees higher.

Q. *Just what does it take to make a 3000 degree refractory castable like B&W Kaocast?*

A. Let's first define a few terms. Refractory castables are made with granular materials which are volume stable at high temperatures and which can undergo repeated heating and cooling cycles without disintegration. These materials, known as refractory calcines or grogs, are blended with suitable hydraulic binders. The initial strength of a refractory castable is thus developed in the same manner as that of ordinary concrete—that is, through the chemical action between water and the binder. A strong *ceramic bond* is formed when the refractory castable is subjected to temperatures above the vitrification point.

Q. *Then you have a grog, a binder and a method of putting them together. Which is most important?*

A. You can't say that any *one* is most important. It's a combination of all three. Let's take them one at a time. Our grog consists primarily of the proper blend of kaolin and other alumina-silica materials. This ratio enables us to achieve a grog with minimum expansion and shrinkage, a high fusion point, and greater stability under load, at varying temperatures.

Q. *And now, what about the binder?*

A. There are a number of factors responsible for the success of the Kaocast binder. One is the compound Tricalcium Penta-aluminate (3 lime to 5 alumina). This formula produces the most refractory compound (highest melting point) that can be made from lime and alumina. Another is that by using the purest commercially available lime and alumina, the Kaocast binder is substantially free of iron and silica. Such traces of these that are present combine during the prefiring of the binder to produce stable compounds.

Q. *Just how important is the manufacturing or "blending" of the grog and the binder?*

A. If one factor could be singled out as "most important" it would be quality control.

Direct control over the fineness of materials, prefiring temperatures, and other phases of manufacture is possible at B&W because both the grog and the binder are made and blended at B&W's Augusta Works—under B&W's direct control and supervision.

Q. *These factors you've discussed must add up to some specific advantages of Kaocast. What are they?*

A. B&W Kaocast has all the advantages of easy installation which are responsible for the widespread interest in refractory concretes, plus these exclusive features: It is the only 3000 degree refractory concrete with high resistance to spalling and low volume change throughout its operating range.

THE BABCOCK & WILCOX CO.
Refractories Division
General Offices:
161 East 42nd St., New York 17, N. Y.
Works: Augusta, Ga.

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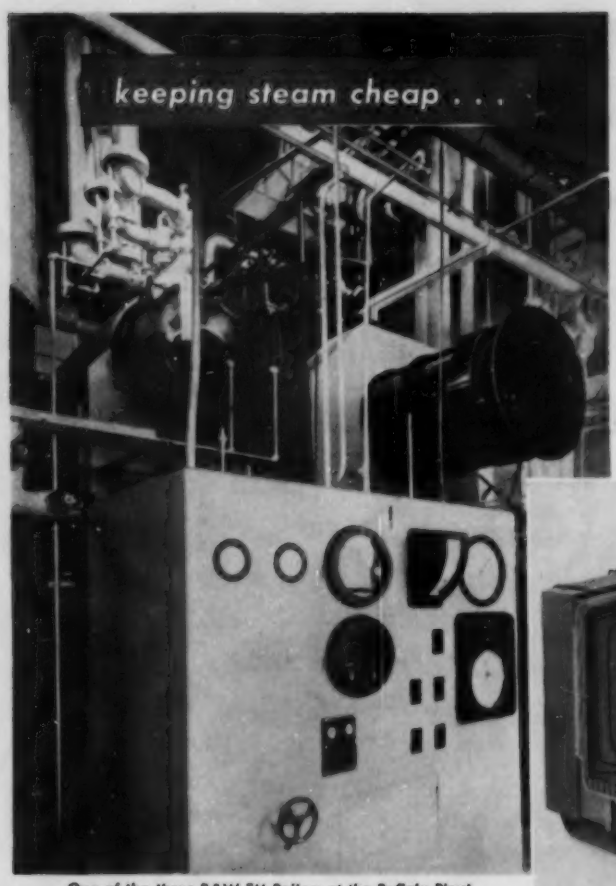
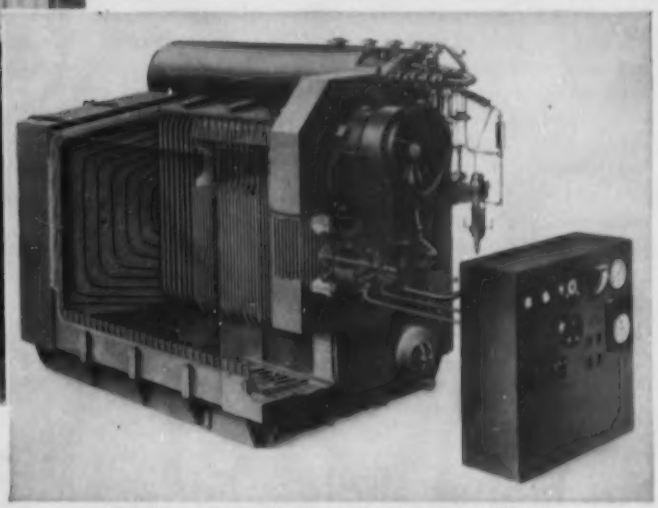


One of the three B&W FM Boilers at the Buffalo Plant.

B&W Type FM Boilers Provide Economical and Efficient Steam Generation at

American - Standard



Typical arrangement showing sectional view of the FM Boiler and the control panel.

Since replacing five old units more than a year ago, three modern B&W Integral-Furnace Boilers, Type FM, have set and sustained high standards for economy and operating efficiency at the Stamping Plant of the American Radiator & Standard Sanitary Corporation in Buffalo.

Selected on the basis of previous experience with B&W Boilers—both FM and larger types—which are now producing steam at various other plants of the company, this multiple-unit FM installation has pleased both management and plant personnel. Overall boiler operating efficiency is 85%. Each of these versatile, self-contained, B&W units has a steam capacity of 27,500 lb per hr and is equipped with fully automatic controls. Designed for pressures to 250 psi, all three FM boilers are providing high pressure processing steam as well as steam for heating.

The choice of B&W FM boilers to supply plant steam requirements is an established trend that is putting more and more of these shop-assembled units into service for the broadest variety of industries, utilities, and other users, both here and abroad. Because it offers compact, "package boiler" benefits along with cost-saving big boiler advantages, B&W's FM Boiler is already in service or on order for a total steam capacity of more than 7,000,000 lb per hr. You can get this unique B&W "workhorse" in a range of standard sizes, for loads from 2900 to 28,000 lb of steam per hr at pressures to 235 psi. It is also obtainable for operation at higher pressures.

Features of B&W Integral-Furnace Boiler Type FM

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space

Write for Bulletin G-76 which gives complete details of the many cost-saving features of this popular, small boiler. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-434

BABCOCK & WILCOX

BOILER DIVISION

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Looking for the right packing for your centrifugal pumps?

For shaft speeds to 1750 RPM Johns-Manville Centripac seals better

WEAR on centrifugal pump shafts as well as on oscillating and rotating rods of other equipment is minimized by J-M Centripac. This is because the square cross section of this packing provides the maximum contact surfaces. Thus, it insures a tight seal with the least friction and gland pressure.

Because Centripac is plaited square it retains its shape indefinitely, thus maintaining maximum surface contact for long periods of time. It is made from long-fiber asbestos yarn, thoroughly lubricated and graphited. It seals against fresh or salt, hot or cold water, oil, ammonia, brine, gasoline, and certain weak acids and other chemicals. Because of its wide application, it is a favorite of plant men everywhere.

For general service, Style #7 Centripac is recommended. It contains no wire, is soft enough to conform readily to the packing space, and stands up well in service. It comes in coil form, Style #C-7 and Ring form, Style #R-7. Sizes 3/32" and up.

For higher shaft speeds, J-M Plastic Packings reduce friction and scoring of shafts and sleeves

Higher centrifugal pump speeds make friction increasingly important in packing and shaft life. That is why J-M Plastic Packings have been designed to have the homogeneous structure and low friction so essential to long packing life in this service.

The exact composition of these packings varies according to the service conditions for which each particular style is designed. As an example, one of these, Style No. 610 is an excellent general maintenance packing for service against steam, air, ammonia, gases, etc. up to 550F. It is made of selected asbestos fiber mixed with pure graphite and a small amount of non-friction metal, then bonded with a heat-resisting compound to form a pliable coil or spiral. It is furnished in sizes of 1/8" and up.

YOUR J-M PACKING DISTRIBUTOR will gladly recommend the right packing for your equipment, and furnish it from stock for your immediate requirements. Write Johns-Manville, Box 60, New York 16, N. Y. for his name and address. In Canada, 199 Bay St., Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS and GASKETS

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"33,000 HOURS proved the choice was right!"

When a prominent North Carolina community converted its power plant to diesel operation, it called in Sinclair Lubrication Engineer Jim Holt for his recommendations on proper lubricants.

Mr. Holt reports, "I recommended Sinclair RUBILENE®. My previous experience convinced me that this diesel lubricating oil would provide maximum wear protection for this power plant's six 1000 K.W. diesel engines. RUBILENE also guards against sticking rings and prevents excessive wear of cylinders, pistons and other moving parts operating continuously for long periods.

"RUBILENE was the right choice," Mr. Holt continues. "After 33,000 hours of near-continuous operation, bearings show very little discernible wear – and there's not a sign of erosive or corrosive action. *Oil consumption is remarkably low,* considering the prolonged operating hours under overload. All six 1000 K.W. engines, with a total output of 6400 K.W. per hour, *use a total of only 1 barrel of oil a day!*"

Why not give a Sinclair Lubrication Engineer the chance to help solve *your* lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

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the pd Decantation Principle

Catches the small ones (flyash) and lets the big ones go . . .

back to the boiler for refiring

Separation of the fines from coarse high carbon flyash for refiring is at last possible in one unit, with no added pressure drop.

Prat-Daniel's Tubular Dust Collector, arranged for Decantation, permits efficient refiring of high carbon dust *without* recirculating the fines!

The P-D two-stage tubular collector is combined in *one* unit yet is no larger in area than a standard P-D Collector. In operation, it requires no additional pressure drop yet assures an extremely high efficiency in the range below 20 microns!

The Thermix Corporation—Project Engineers for Prat-Daniel—will be glad to show you how Decantation saves fuel and eliminates poor combustion resulting from total re-injection.

Ask them for full details on P-D Dust Collectors, Fan Stacks, F.D. and I.D. Fans. P-D Unit Responsibility on these components relieves you of the necessity of integrating equipment from various sources . . . helps make your operation more efficient, less costly. It will pay you to call Thermix today.

Ask for P-D Catalog 4-P201.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks.

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DYNAMATIC®

EDDY-CURRENT ROTATING EQUIPMENT

is Solving Problems for Every Major Industry

Wherever a requirement exists for an adjustable speed clutch or brake under precise control, operating from AC power, you will find Dynamatic Equipment. In practically every major industry — paper, rubber, automobiles, aeroplanes, machine tools, metals, chemicals, cement, lumber, ceramics, petroleum, plastics, and in leading research laboratories, Dynamatic Equipment has been found the ideal solution to difficult problems.

Dynamatic engineers will be glad to work with you in specifying the proper Dynamatic Equipment to meet your requirements.

Write for your copy of Bulletin GB-1, which describes and illustrates the basic Dynamatic units.

There are Dynamatic representatives in most principal cities. Contact your local representative or write direct to the factory, Kenosha, Wisconsin.

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KENOSHA, WISCONSIN • General Offices: Cleveland, Ohio

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R/M's BIG 7 Packing Types meet 95% of all packing needs

Triplex pumps like this one, which is used to supply hydraulic pressure for molding presses, give top performance with R/M Vee-Flex®, a packing included in Type 7 of R/M's "Big 7" Packing Types.

Let R/M packings reduce your downtime

With R/M's "Big 7" Packing Types you will be able to practice preventive rather than corrective maintenance. With them you will have greater assurance of machinery protection and a chance to schedule your downtime. You will, because this basic line of just seven field-tested packing types is engineered to give custom-built performance in all but the very rarest packing applications. Your plant can probably standardize on just three or four of R/M's "Big 7" Packing Types. If so, this also means lower inventories and simplified ordering. Your R/M distributor has the full details. Call him in and start benefiting right away.

R/M PACKINGS FOR MAINTENANCE PURPOSES ARE SOLD ONLY THROUGH AUTHORIZED R/M DISTRIBUTORS

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RAYBESTOS-MANHATTAN, INC., PACKING DIVISION, MANHEIM, PA.

BIG 7 PACKINGS

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada.

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

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Before You Blame the Machine

it may be Varying Voltage Trouble!

You Need a STABILINE Automatic Voltage Regulator

V.V.T. (*V*arying *V*oltage *T*rouble) can "raise hob" with automatic production and process control where timers, solenoids, or electronic gear is used, and in the inspection department, too.

For years production men have put up with V.V.T. Many times they did not know it existed — it was just "trouble". When they did know, they substituted makeshifts to get around it.

Ask your Electrical Engineer. He'll diagnose the trouble. And when he recommends a Stabiline Automatic Voltage Regulator, you'll know those troubles, at least, are under control.

STABILINE EM AUTOMATIC VOLTAGE REGULATOR FEATURES:

1. Available for single and three phase duty in capacities up to 100 KVA. 115V, 230V and 460V units.
2. Zero waveform distortion
3. Rapid correction
4. High efficiency comparable to fixed-ratio transformers

Be sure to see Superior Electric's Mobile Display when it is in your area.

THE SUPERIOR ELECTRIC COMPANY

2105 Clarke Ave., Bristol, Conn.

Manufacturers of: Powerstat Variable Transformers • Stabiline Automatic Voltage Regulators • Voltbox A-C Power Supplies • Powerstat Light Dimming Equipment • Variac® D-C Power Supplies • Superior 5-Way Binding Posts

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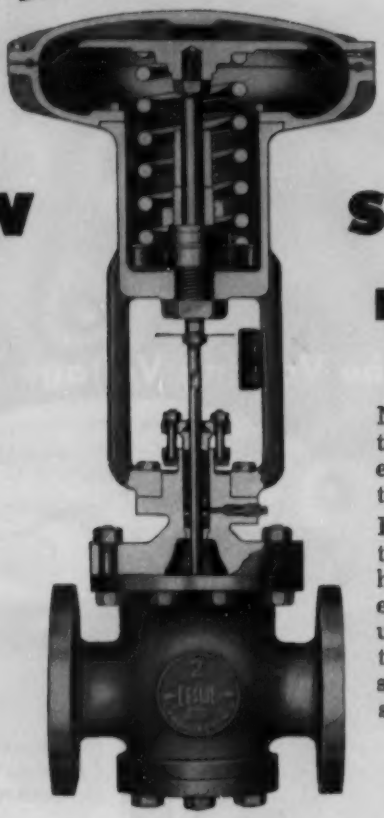
something **SPECIAL** in a **STANDARD** control valve...

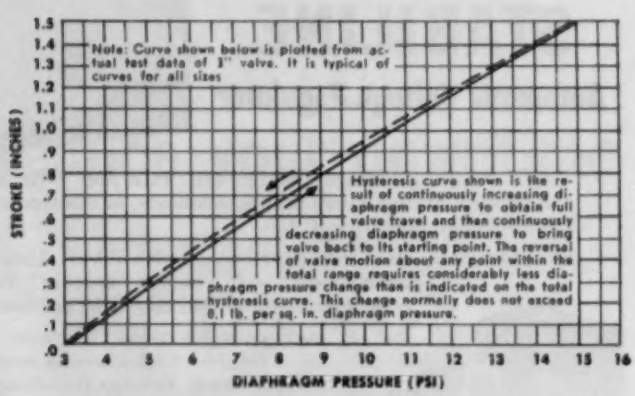


NEW SUPERSTRUCTURE

FOR LESLIE DIAPHRAGM CONTROL VALVES

Now standard for *all* Leslie Diaphragm Control Valves, this new rugged, precision stroke, superstructure means even more reliable performance than the high level set in the past by Leslie.

For instance, linearity (the straight line relationship between diaphragm pressure and inner valve movement) is held to plus or minus 2% for valve strokes up to 1½"—equivalent to .020" for valves with 1" stroke without using valve positioner. Hysteresis, the difference in position of the inner valve on the up and down strokes for the same diaphragm pressure, is held to 2% of full valve stroke for travel up to 1½". Here is the curve.


Note: Curve shown below is plotted from actual test data of 3" valve. It is typical of curves for all sizes
Hysteresis curve shown is the result of continuously increasing diaphragm pressure to obtain full valve travel and then continuously decreasing diaphragm pressure to bring valve back to its starting point. The reversal of valve motion about any point within the total range requires considerably less diaphragm pressure change than is indicated on the total hysteresis curve. This change normally does not exceed 0.1 lb. per sq. in. diaphragm pressure.
STROKE (INCHES)
1.5 1.4 1.3 1.2 1.1 1.0 .9 .8 .7 .6 .5 .4 .3 .2 .1 .0
3 4 5 6 7 8 9 10 11 12 13 14 15 16
DIAPHRAGM PRESSURE (PSI)

Only Leslie gives you all of these "made-to-order" advantages in a standard valve.

- ✔ Full-flow, smoothly contoured body
- ✔ Renewable, interchangeable seat rings
- ✔ Bolted stuffing box
- ✔ Molded rings or Teflon packing
- ✔ Thermo-isolating bonnet
- ✔ Accurate part replacement from name plate data
- ✔ Stem flats for ease of connection

Send for
Bulletin 5304 (Single Seated Diaphragm Control Valves)
Bulletin 5305 (Double Seated Diaphragm Control Valves)

TRADE LESLIE MARK
REGULATORS SINCE 1900
STILL FAR AHEAD IN QUALITY AND PERFORMANCE

LESLIE CO., 263 Grant Avenue, Lyndhurst, New Jersey

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New diesels get same "lube diet" that kept old units healthy...

For many years, the Las Animas Municipal Power and Light Company kept its original diesel equipment operating at remarkably low cost. Using Standard diesel oils, down time and maintenance were negligible in spite of greatly increased loads that forced the units far beyond their rated capacities.

In 1951, when two new 1750 hp. Nordbergs were installed in the Las Animas, Colorado, power plant, it was natural for plant officials to select STANDARD HD Diesel Oil on the basis of this outstanding past performance.

Used exclusively in the new units, STANDARD HD has set a new high for healthy performance. In over two years of continuous hard service, STANDARD HD has supplied clean, protective lubrication. After 6000 hours of operation wear was so slight that it could not be measured; engines are kept clean constantly in all working parts.

STANDARD HD
TRADE MARK
OIL

• Diesel plant operators throughout the Midwest have discovered they can count on low cost diesel operation when they use STANDARD HD Oil. STANDARD HD provides an economical solution for costly maintenance problems—ring sticking and breaking, carbon deposits, cylinder wear—because STANDARD HD Oil lubricates, cleans *and* protects.

A Standard Oil lubrication specialist stationed near your plant throughout the Midwest can help you secure successful results in the operation and maintenance of your diesels. For his services, call your local Standard Oil Company office. Or write: Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois.

Ralph Barbee, plant superintendent of the Las Animas Municipal Power and Light Company, checks the operating log with E. C. Jeffries, Standard Oil lubrication specialist.

STANDARD OIL COMPANY
(Indiana)

STANDARD

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Sure, that old pump still works,

but how much does it cost to keep?

That rugged old pump of yours may not be the bargain that it seems. Let's do some arithmetic. If the efficiency of the old pump is 75% vs. the 85% efficiency of the new pump, you are paying more to keep it than you would to replace it. That's because a new unit of equivalent output uses less power. Thus it soon saves its own cost — then begins to pay dividends.

Let's take a specific example — a small boiler feed pump

Old pump efficiency 63%	99.5 BHP
New pump efficiency 69%	91.0 BHP
	8.5 BHP Saving

On the basis of 1¢ per KWH, the 8.5 BHP saving for 8,760 hours (a year of continuous operation) amounts to $560. This saving, capitalized in 10 years at 4%, adds up to $6,700. Yet the price of the new pump that saves $6,700 is only $1,101.

What would the pump replacement profit be in your particular case? Your De Laval representative can tell you exactly — in dollars and cents — as soon as he has the basic facts on your present installation. Call him in today or write to De Laval for Pump Fax Bulletin which includes a valuable "power-savings" chart.

DE LAVAL *Pumps*

DE LAVAL STEAM TURBINE COMPANY
857 Nottingham Way, Trenton 2, New Jersey

GA-207

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Wagner®
TRANSFORMERS
...the choice of leaders in industry

CHOOSE WAGNER UNIT SUBSTATION TRANSFORMERS

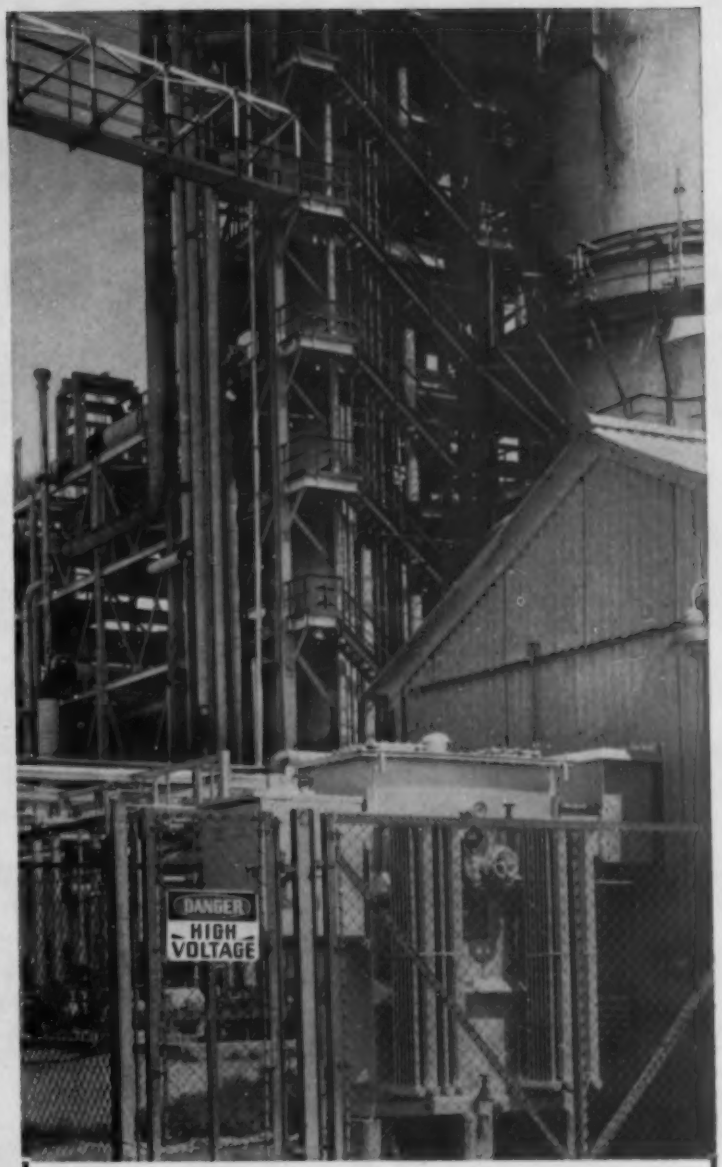
for always dependable power...

Here's dependability at work! This Wagner liquid-filled unit Substation Transformer feeds the catalytic unit at The Carter Oil Company refinery in Billings, Montana.

You'll find hundreds of Wagner Transformers, furnishing *always dependable* power, in spots where failure would incur great cost, because Wagner Transformers are known for their unfailing dependability—a reputation backed by more than sixty years of transformer building experience.

Wagner Unit Substation Transformers, both liquid-filled and dry-type, are carefully designed to meet distribution requirements. Both liquid-filled and dry-type unit substation transformers are built in ratings through 2000 kva, 15 kv and below—you can choose the type and rating that exactly meets your load-center distribution requirements.

Bulletins TU-13 and TU-56 give full information. Your nearby Wagner engineer can help you solve your load-center problems. Call the nearest of our 32 branch offices, or write us.



This 750 kva, 2400/4160Y to 480 volt, 60 cycle, three-phase, liquid-filled Wagner Unit Substation Transformer feeds the catalytic unit at The Carter Oil Company, Billings, Montana refinery. It is throat connected to switchgear in the adjoining building. Purchased and installed by The Fluor Corporation, Ltd., Engineers and Constructors for the Petroleum, Chemical and Power Industries, Los Angeles.

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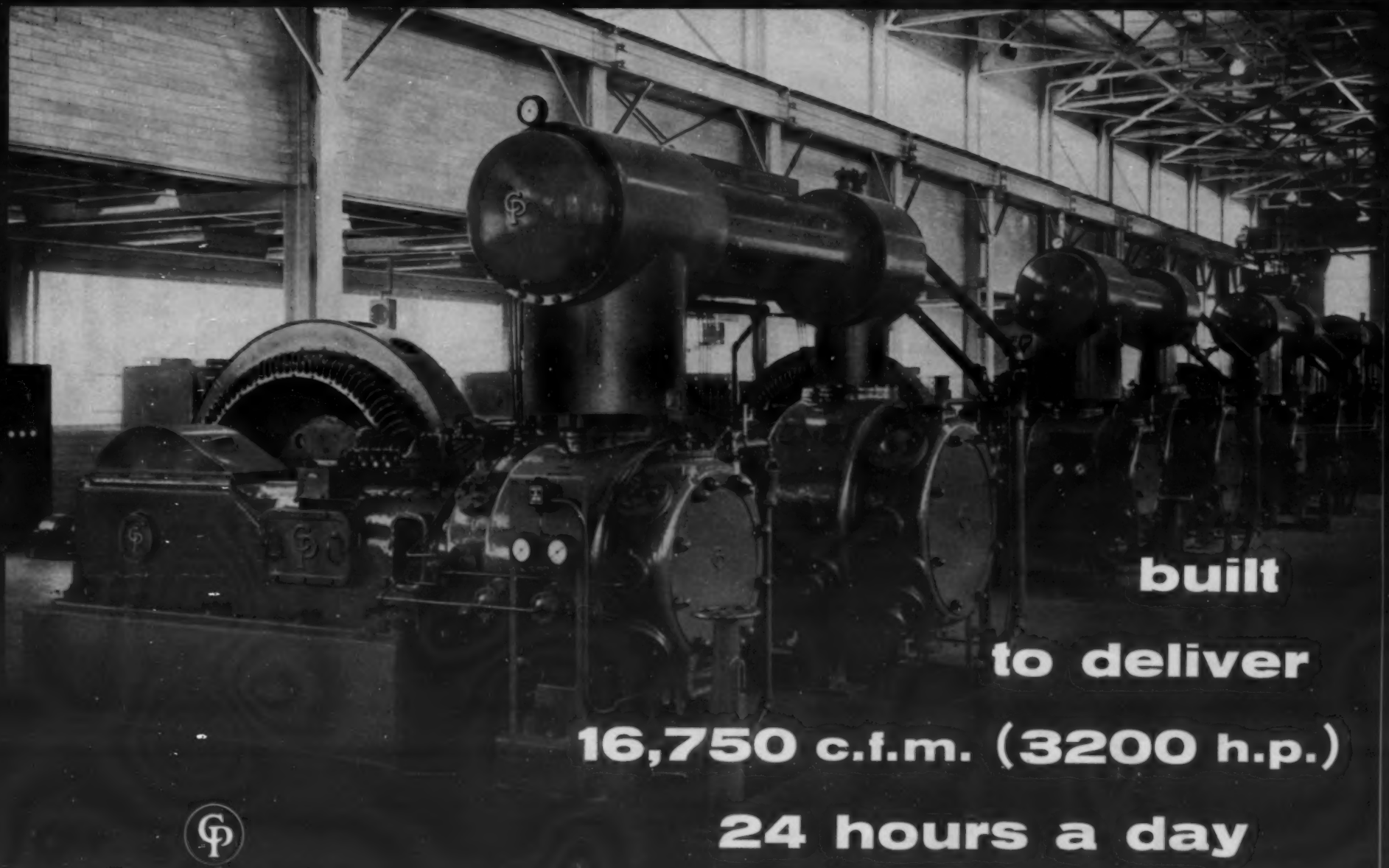

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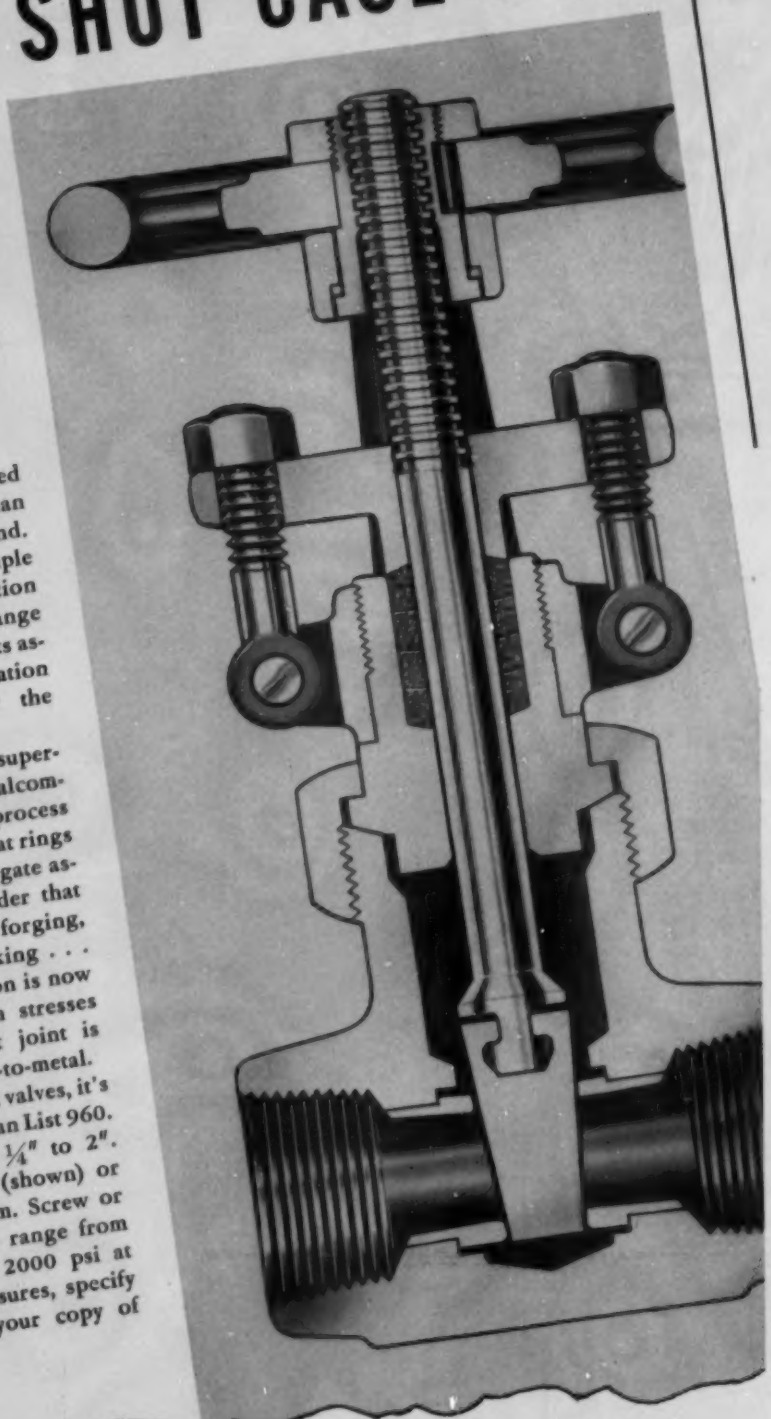

The **CHAPMAN VALVE**
MANUFACTURING COMPANY
Indian Orchard, Mass.

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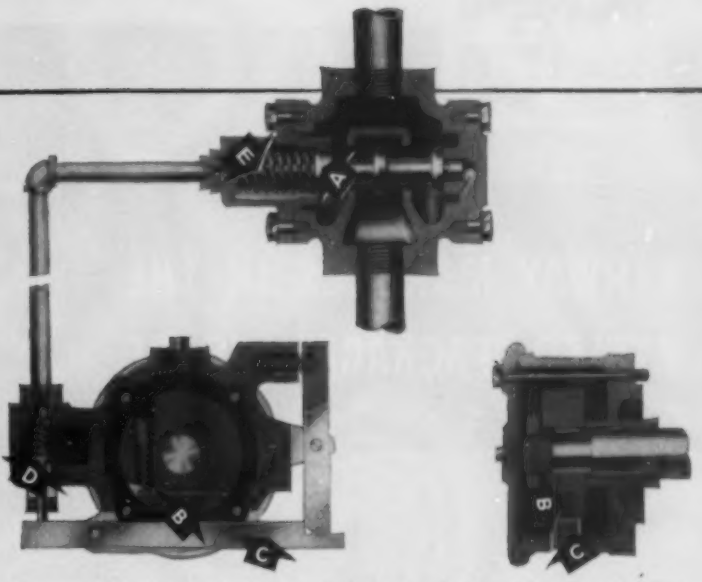
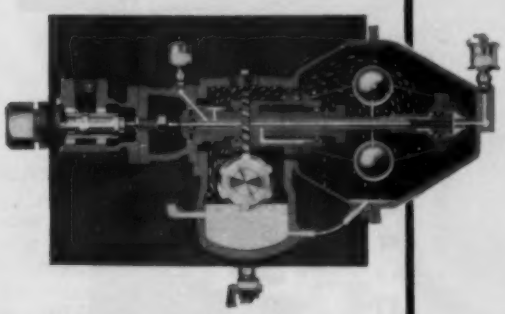
Only Coppus Turbines offer you *a pilot operated* excess speed safety trip



The constant speed governor on Coppus Turbines, plus this Excess Safety Trip, gives you extra protection for your turbine investments. Here's how it works. When turbine is operating, Lever C is horizontal, Pilot Valve D closed, and Valve A held open by Spring E. When excess speed is reached, centrifugal force throws Weight B against Lever C, opening Pilot Valve D. This relieves the pressure back of Valve A, unbalancing and closing it immediately, compressing Spring E and shutting off the steam supply to the turbine. When Lever C is manually reset, Pilot Valve D closes, allowing pressure to build up back of Valve A and thus restoring the balance. Spring E then opens Valve A, admitting steam to turbine.



Sectional view showing lubricating system of fully enclosed Coppus Constant Speed Governor. Governor head acts directly on stem of steam admission valve. No external levers required. Ball bearing construction eliminates end play and gives frictionless operation.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

CUT YOUR COSTS PER HORSEPOWER

When you choose from the Coppus Steam Turbine line, you get the right size for your requirements . . . and make substantial savings on *any* size from the 150 hp turbine down to the smallest. Low in first cost, Coppus Turbines save you more money in the long run. Operating and maintenance costs are kept low by such other features as: large number of steam nozzles, controlled individually by manually operated valves; hard chromium plating on shaft at the stuffing box; replaceable cartridge type bearing housings; optional carbon ring packing assembly for back pressures up to 75 pounds.

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORPORATION, 185 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

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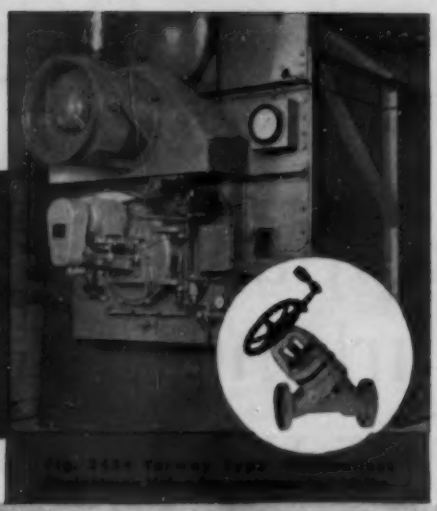
YARWAY MARCHES IN THE KEELER "PACKAGE" PARADE



● Among other marks of quality on package boilers that "roll out" of E. Keeler Company's plant—are Yarway Blow-Off Valves.

Keeler knows what many other boilermakers know . . . that a *good* package-type boiler is *better* when equipped with Yarway Seatless Blow-Off Valves.

Over 15,000 boiler plant operators also know and appreciate Yarway Blow-Off Valves . . . their simplified design, dependable operation, long life, low cost maintenance.

Want more details? See Yarway Bulletin B-426.

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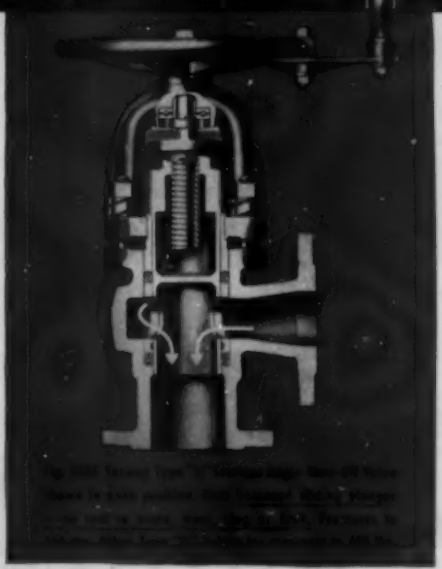

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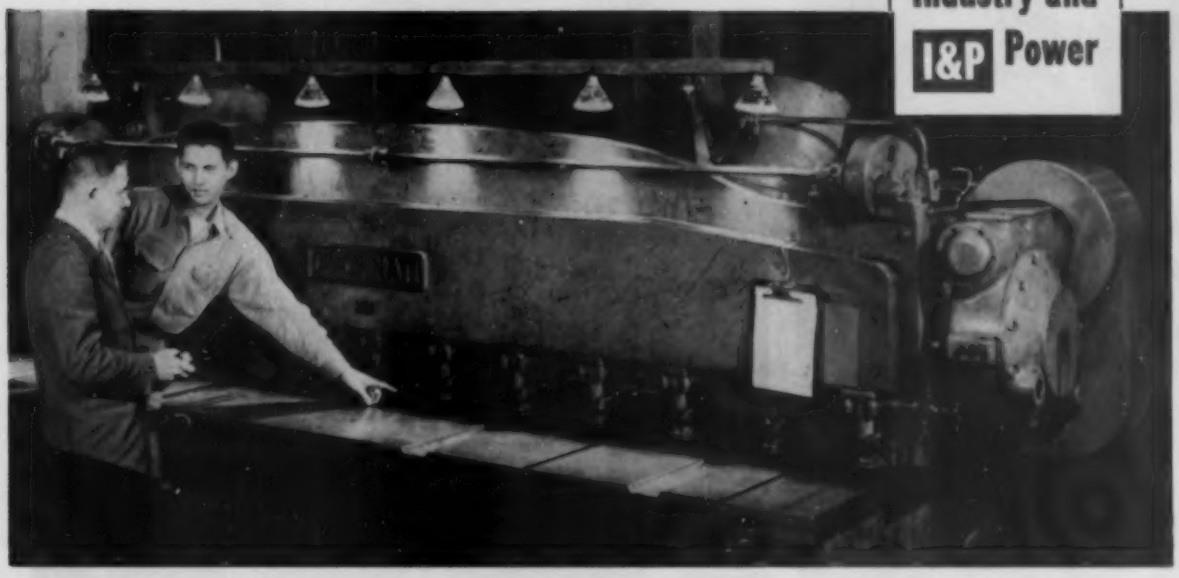


Six lamps are mounted so light is directed through slot along edge of shear blade; shadow forms where blade cuts.

Extra Light for Critical Seeing

E. A. LINSDAY
Application Engineering Department
General Electric Company

MANY SEEING tasks in industry require higher levels of illumination than those provided by a general lighting system. Tests show that 70 times more light is required in a precision die-making task than is needed for equal visibility in reading printed type in a magazine. For applications where brightness contrast is poor, such as black thread stitched on black cloth, additional light should be provided by supplementary units. This is also true where small detail must be seen, as in fine assembly work or inspection. Some such applications use as much as 2000 footcandles to make the tasks visible.

These relatively high levels of illumination can be provided by louvered or shielded reflectors or by projector lamps. Properly shielded fluorescent lamps are being used to increase the visibility of difficult-to-see tasks where additional light is needed.

It is usually best that supplementary lighting units be permanently positioned to discourage adjustments by the worker. If not permanently installed, the workers may readjust them incorrectly so that they become a source of glare to the worker himself or to others in the area.

Any supplementary lighting system means an additional maintenance problem but well constructed, permanently installed units minimize this. However, portable lighting units are sometimes required when the general lighting system does not provide enough illumination and where the working position is not always in the same location. These portable units should be well built to withstand the handling which they receive.

A narrow controlled beam of light

Two 40-watt filament lamps behind opal glass illuminate motor housing for cleaning out weld spatter; fluorescent lamps could be used equally well.

Directional light (above), colored lights (below) improve inspection.

Welder is provided with 1500 footcandles to see where to strike arc without lifting mask; when arc is struck, he turns out light with foot pedal.

striking a surface at an angle will make surface flaws, irregularities, pit marks, scratches, and cracks appear as highlights and shadows on nonspecular material. This technique is often used to inspect materials for these defects. Specular surfaces can be examined under directional light also if the sources are positioned so that the beam is reflected away from the eyes of the observer and other workers in the area. When this is done, the entire surface will appear dark except for the defects, which reflect the light and appear bright.

Directional Sources

Light sources for this type of surface inspection should be highly directional. Narrow-beam reflectors, lenses, or spot lamps are generally necessary for accurate control. Self-contained reflector and projector lamps are well suited to these inspection applications.

Examples of surface inspection by directional light include looking for wrinkles in roofing materials, detecting defects in coated paper sheets, and checking the uniformity of sandpaper.

Materials such as glass and clear plastics can often be inspected more easily when edge lighting is used. When the edge of an object such as a pane of glass is placed in a narrow illuminated slit, the light enters the glass and is internally reflected throughout the piece. When the light strikes surface scratches or internal defects, it is diffused, making the defects appear bright. A dark background usually makes such defects much easier to see.

Diffuse Sources

In assembly or inspection operations where the work surfaces or parts of them are shiny—such as in the inspection of highly polished sheet metal—low brightness luminous-panel-type luminaires are desirable. These large diffuse sources minimize bright reflections, and make it possible to illuminate the work at required levels without discomfort from reflected glare. Luminaires for this service should be relatively uniform in brightness, and diffusing cover plates are recommended. Micrometers, metallic scales, and dials involved in the operation of machine tools are much easier to read under large diffuse luminaires than under small high-brightness sources.

Transparent objects such as glass jars, bottles, bulbs, and clear plastics can be examined for blisters, cracks, chips, and air-bubbles when viewed in front of a large luminous panel. A concentrated spot-type light source has often been found useful for this type of inspection. These concentrated light sources cause cracks, chips and air bubbles to sparkle, making them easier to detect.

The inspection of fabrics for defects in seams, weave, and stitching can often be made easier by transilluminating them.

Another method of inspection uses controlled reflections. Dents, scratches, and dings can often be detected in specular surfaces by viewing the reflected image of dark lines painted on the luminous panel when the object is illuminated by this panel. This same method can be used to check a specular surface for proper contour.

Black Light

Black light, used on fluorescent materials that glow when irradiated by it, is finding wider industrial applications. Fine fluorescent powders are wiped across metal surfaces; they lodge in imperfections and show these defects clearly under black light. In laundries, articles marked with fluorescent ink that is invisible under normal light can be identified easily and quickly under black light.

Mercury and black-light-type fluorescent lamps, with their visible radiation screened out by special fil-

ters, can be used to provide the near-ultraviolet radiation for these applications. Projector-type mercury lamps incorporating built-in reflectors are available in the 100-watt size to supply black light when used with the proper filter. A special phosphor in the black-light-type fluorescent lamps make them efficient sources of blacklight.

Polarized Light

Polarized light makes possible the detection of internal strains in transparent objects. When light is passed through a polarizing screen, through the object being examined, and then through another polarized screen the areas under stress appear as colored patterns. In this manner internal strains which might cause the early failure of mounted lenses, lamp bulbs, radio tubes, and transparent plastics, can be detected at the manufacturing plant.

By constructing a transparent plastic model, stresses in opaque machine parts can be studied in a similar manner. When the model is placed under external forces proportional to those the actual piece will encounter, the area under strain appears streaked with colored fringes. The relative value of these internal stresses can be determined and their effect on the machine part can be analyzed in this manner.

Optical Magnification

Large lenses of moderate magnification may serve for inspection of extremely fine details too small for direct observation. Also, projection on a screen of enlarged silhouettes of objects has been used successfully. The magnified silhouette method is used in inspection of coiled tungsten wire filaments, in checking the teeth of production gears by projecting a silhouette on a profile chart, and in observing the meshing of production gears with a perfectly cut standard. When lenses are used, a well-shielded luminaire which provides very high illumination on the work should be used. Circular fluorescent lamps have special advantages for this service.

The deluxe cool white fluorescent is the best single source for all types of color work. However, for critical color matching, it is found that no one source is completely satisfactory; colors which match under one illuminant will not necessarily match under another. For the most accurate work, two sources of different spectral characteristics are used. The match is made under one and then checked under the other. Satisfactory matches under the double-source system will match under any other type of lighting. For satisfactory color matching, illumination from 200 to 400 footcandles is desirable, and the light should be well diffused.

Color discrimination, on the other hand, such as the grading or shading operation in tobacco or cotton, generally requires a source approximating the one under which the observer

Diffusing panel is built into inspector's bench top. Fluorescent lamps below illuminate the seams, weave, and stitching in this parachute cloth.

Built-in circline fluorescent lamp lights up magnifier's field of view, insuring accuracy and eye comfort.

Filament lamp, mirrors, and microscope are combined in this inspection station for lamp filaments.

was originally trained to inspect.

These supplementary lighting techniques provide added illumination for specific purposes. There are very few instances where general lighting is not required also. This holds true whether supplementary lighting is necessary or not, for supplementary lighting, no matter how well executed, cannot provide a proper balance or over-all comfort and visibility. This is possible only with a good general lighting system.

When ideal seeing conditions are achieved, a worker, pausing to look out beyond his immediate work zone will not encounter a startling visual contrast. Severe contrasts are too often found in shops where general lighting is neglected, and where the worker sees the dark shadows of a poorly lighted general area in shifting his eyes from his well-lighted task. As is often the case, his eyes might also encounter sharp glare from a window or lighting fixture. This seemingly unimportant, and often unnoticed, visual shock may occur innumerable times through the day. This can temporarily impair the worker's ability to see his own work with the precision necessary. Many tests have shown that long exposure to this condition produces considerable visual fatigue.

Top-notch supplementary lighting costs very little compared to over-all factory operation expense; yet it can often bring about substantial savings by enabling highly paid workers to accomplish more work of higher quality in the same time and space without extra effort or speed-up. When people see better, they just naturally work better.

Standby Diesels Supply Emergency Power

STANDBY POWER requirements, along with expansion of the power distribution system, presented a growing problem in the economical operations and safety of the aircraft plant at Columbus, Ohio, that was taken over by North American Aviation, Inc., in 1950 for production of jet aircraft parts. The problem resulted from an increase in production far beyond the original capacity of the plant, which formerly was used to manufacture piston-engine type aircraft.

Increased man-hours of work on jet aircraft frames (at present 17,000 employees are required for "round the clock" operations) and expansion of the plant necessitated a careful redistribution of electric power and installation of standby facilities. When this was completed recently, the normal power consumption exceeded the peak loads of the plant during the war years. Conversion was accomplished over the past two years under the guidance of V. R. Little, superintendent of maintenance, and Frank A. Mason, plant electrical engineer.

The magnitude of the program is indicated by the plant's power demand of 11,500 kw, which is brought into the plant at 40,000 volts by multiple tie-ins to power supplies of nearby cities. Since this arrangement did not prevent power failures, standby facilities were required to maintain a safe level of illumination, keep plant communications working, supply the fire alarm system and stationary fire equipment with power, and provide other types of protection not common in some industrial plants. Among these are outside floodlighting and operation of motor driven sump pumps for drainage of heavy rainfall or water that would collect during fire fighting.

Standby Facilities

Solution of the standby power problem was based on a careful study of essential functions. For example, calculations indicated that power for one light in 25 would be required for emergency illumination of the acres of factory floor and the offices. When all of the emergency power requirements were totaled it was concluded that a 200-kw generator would adequately protect the plant. For power to drive the generator, a heavy duty Superior, spark ignited, natural gas fired engine rated 295 bhp at 900 rpm was selected. This main standby unit, consisting of a National Supply Co. engine and Elliott Co. generator was installed in the power house.

In addition, two other small standby generators were purchased. One of 40-kw capacity is in the main warehouse and another of 15-kw capacity is used in the company-operated radio control tower. These may be operated independently.

Automatic Operation

Several features of automatic operation make these emergency power facilities practically foolproof regardless of storms or other causes of power utility line or in-plant breakdowns. Air, gas engine, and battery power are available for automatic starting. Switchgear includes an electrically operated breaker to connect the emergency power source to the common load bus, and a similar breaker for connecting "normal power" to this bus. An auxiliary panel is equipped with engine alarm, shutdown control, and automatic emergency power control.

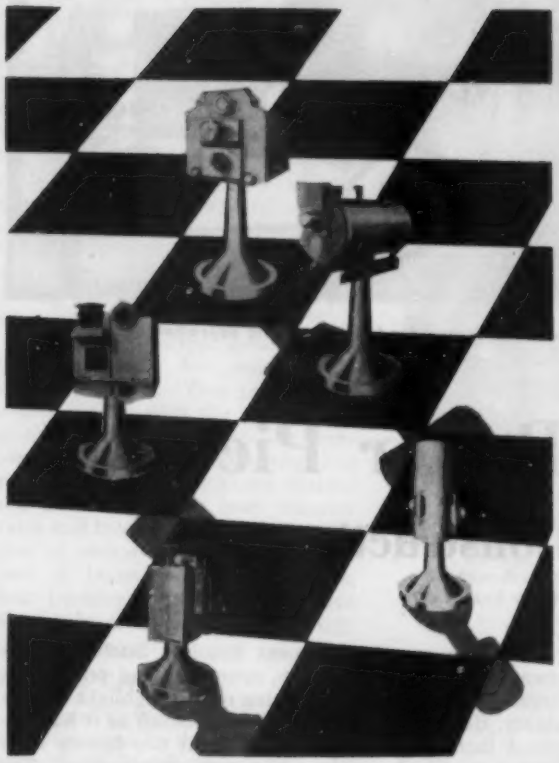
An emergency control switch provides for either automatic load pick-up or manual starting. Under automatic control, the engine is started by an air motor if the voltage of the normal power supply drops below a predetermined value. This will be preceded by a bell alarm and a pilot light indicating normal power is off. When the standby generator voltage reaches proper value the normal power breaker opens and the emergency power breaker closes.

These automatic operations will take place in the reverse order when the normal power source returns to its proper value. To provide for regular testing of the equipment, a test control switch is operated to simulate a power failure.

Further protection of the engine against defective oil pressure, excessive water temperature, and speed is provided by means of an alarm and shutdown control on the auxiliary panel. As the engine starts and lubricating oil pressure increases, automatic energization of these controls is indicated by a pilot light. Stopping is accompanied by automatic reversal of this sequence. Storage batteries energize the alarm panel when the standby engine stops and there is no other power available. All pilot lights and alarms can be tested at any time either while the engine is idle or running.

The Packaged Boiler Picture

Trends in Design and Construction

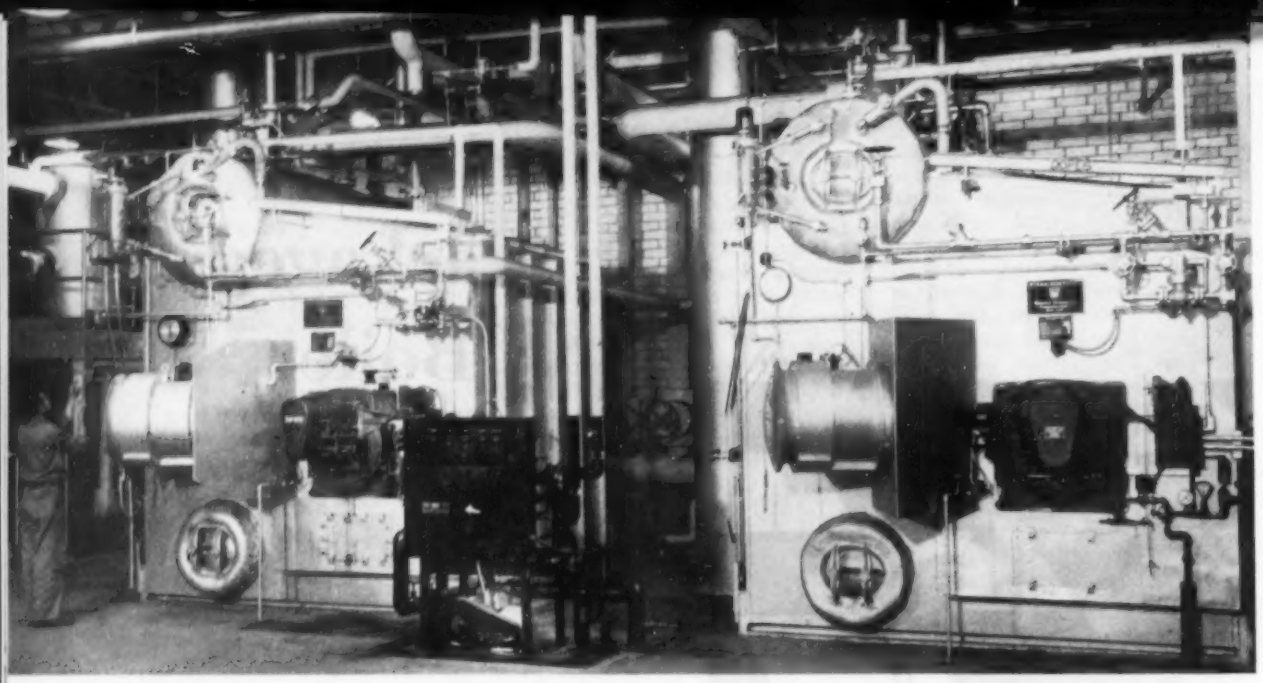


STAFF REPORT

PREASSEMBLY OF BOILERS in the manufacturer's shop has increased markedly during the past few years. Industrial customers like the idea of buying a completely packaged unit with integrated auxiliaries, thereby minimizing both the costs of field erection and the necessity for in-plant coordination of engineering detail. Efforts can be directed primarily at selecting the proper design to provide satisfactory operation for the specific service requirements.

With any piece of mechanical equipment, misapplication or mistreatment can create problems, and in this respect the packaged boiler is no exception. This study shows that its limitations now are more clearly understood, and the need for adequate supervision, proper service facilities including feedwater conditioning, and preventive maintenance is recognized by the users. Meanwhile, manufacturers are constantly improving their designs. As a result—the future appears bright.

To order additional copies of this report, use coupon on page 145



These 10,000 lb per hr Foster Wheeler packaged water tube units are arranged for fully automatic operation on heavy oil.

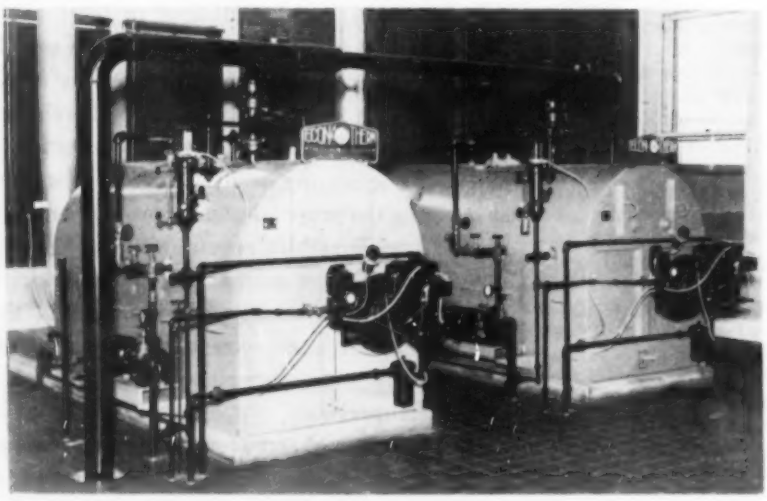
The Packaged Boiler Picture

Trends in Design and Construction

IN THE PAST several years, industry has exhibited an intense interest in the several types of preassembled steam and hot water generating equipment, or packaged boilers, as they are commonly called. The reasons for this trend are self evident. A factory assembled product, which includes all auxiliary equipment, provides a coordinated, engineering design that assures optimum performance. Minimum effort is required at the project site to place the equipment in service, and if relocation becomes desirable, such procedure is a simple matter. The purchaser also can arrange the original installation in a multiple number of units to assure high operating efficiency under all load conditions.

With the trend toward preassembly, the word "packaged" has become one of the most used, and frequently abused, terms ever applied in the steam generating field. Currently, the label is being extended to include various auxiliaries, such as burners, controls, water treatment systems (or even system components), continuous blowdown facilities, and other related boiler plant equipment. The inference is "here is everything needed in one package"—and fortunately most manufacturers take great care to assure safety and reliability. But purchasers must understand that even carefully designed and engineered equipment requires intelligent application, operation, and protection.

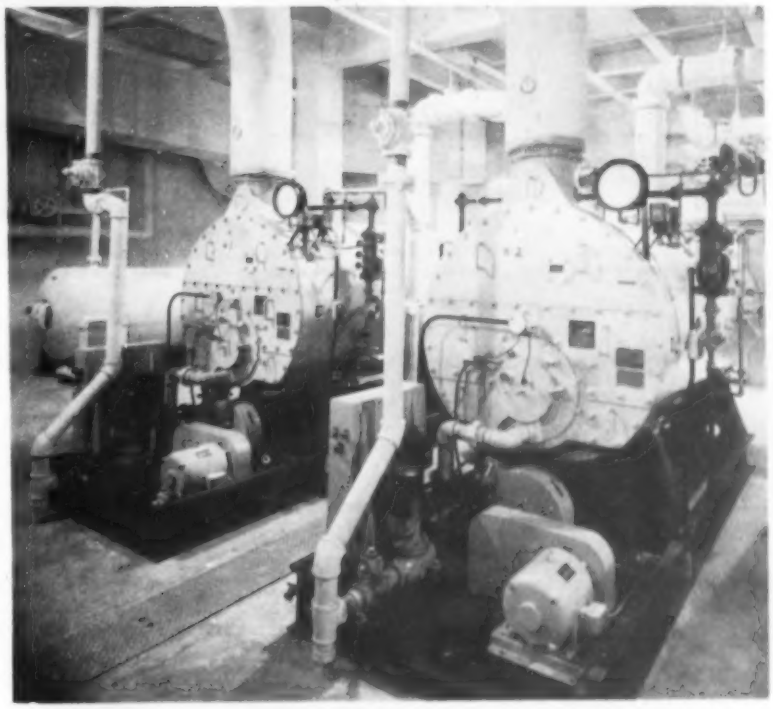
Operating results highlight the importance of this detail as it has become evident that two factors warrant additional consideration. The



Hapman-Dutton's modified Scotch type boilers have off-center firing; operate on induced draft. Two, 100 hp units shown here are in a municipal water works.

first is the question of operating labor or supervision. Many of the early installations were run virtually unattended — and some still are. This procedure, however, is not in accordance with the fundamental concepts of good judgment for operating any fired pressure vessel. The packaged automatic label fostered this condition, and all manufacturers now are cognizant of the care and treatment (or lack of it) their equipment will receive. Leading manufacturers of packaged boilers, however, have made serious efforts to point out to their customers, the advantages of planned maintenance. At the same time, efforts are constantly being directed at producing designs that will provide for all contingencies.

The other principal consideration is the necessity for proper feedwater treatment. This problem, of course, varies with the specific application, but should not be neglected, as serious difficulties can result. All of the packaged designs use relatively high heat transfer rates and incorporate a high proportion of steam generating area per unit of boiler volume. Therefore, heat transfer surfaces must be kept absolutely clean to maintain design performance.



Cleaver-Brooks uses four-pass construction, combustion air being supplied by a forced draft blower. Above 80 hp units are in a high school in California.

Packaged Designs

Originally, the packaged concept was pioneered by the manufacturers of modified Scotch marine fire tube units. They produced a self-contained packaged boiler, where the boiler with integral furnace and all refractories was shipped from a single manufacturer complete with burner, all burner controls, forced draft blower, water column, water level controls, steam gage, and oil preheating and pumping equipment. However, with the development of automatic firing methods to the high degree of precision reached within the past seven years, water tube units also have become very prominent in the field. Some of these designs overlap the applications normally associated with fire tube units, but the extent of overlap is far less than casual investigation of equipment catalogs might indicate.

In the very small sizes, flash and controlled recirculation designs cover the same ranges as fire tube boilers, but the fields of application are so dissimilar that the various types hardly can be termed competitive. Standard water tube units also

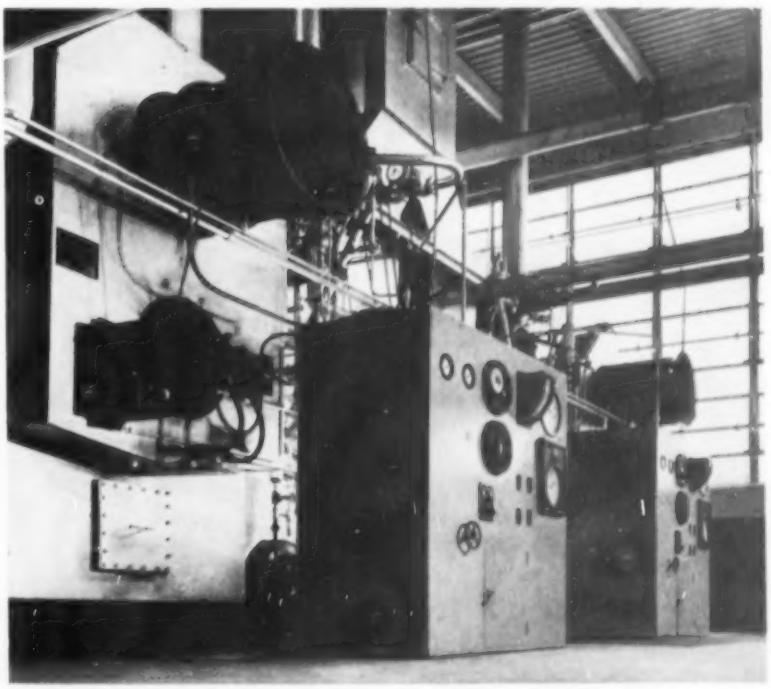
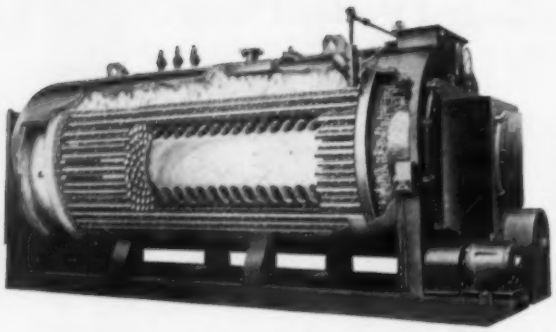
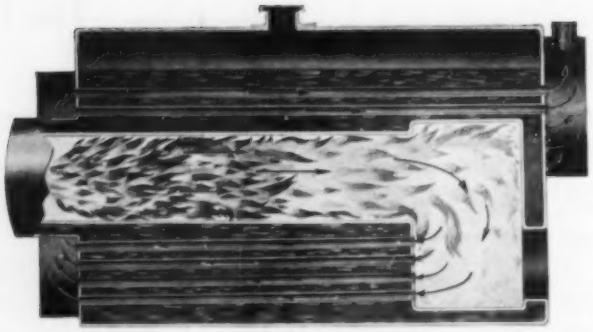


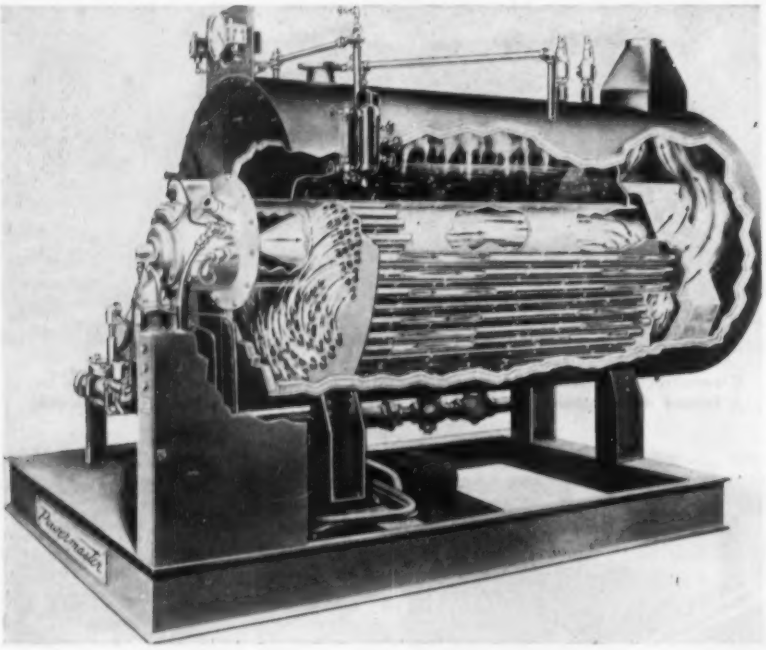
Photo of a Babcock & Wilcox installation illustrates a typical arrangement of vertical two drum steam generators. Control panels are by Bailey Meter Co.



Boiler Engineering & Supply's Continental boiler is a horizontal fire tube unit of modified two-pass design.



The waterback design of Johnston Brothers' modified three-pass Scotch type unit eliminates all rear end refractory.

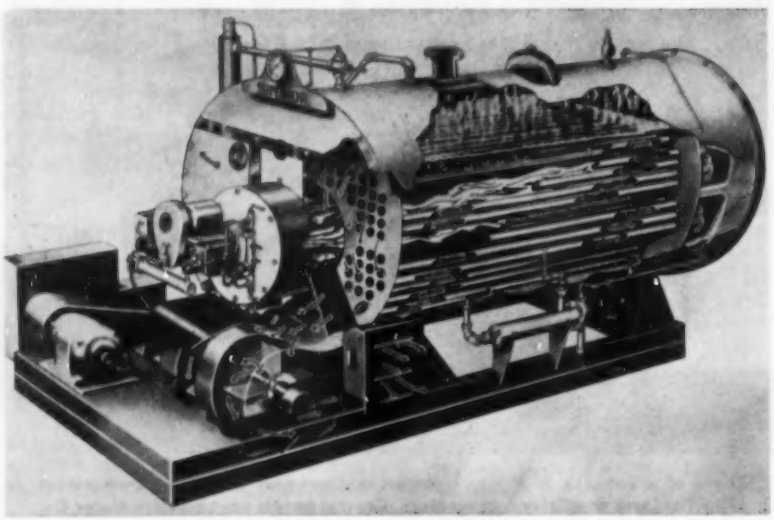


Orr & Sembower's packaged automatic boiler is a three-pass design, fired by air atomizing type burners.

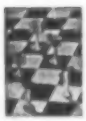
extend well down into the range of the fire tube field, some companies listing units as small as 2500 lb per hr. However, most water tube manufacturers, guided by their experience in the large industrial and utility fields, recommend more complex auxiliary equipment, and this often penalizes their economically competitive position in sizes under approximately 10,000 lb per hr. This comparison applies only to single units and does not presume to include multiple unit installations.

Initial Cost

With all types, possibly the foremost reason why the purchase of packaged designs has increased appreciably is low initial unit cost. While generalization is difficult, various estimates indicate equivalent capacity in oil or gas fired packaged designs can be purchased for 50 to 80 percent of the investment required for a field erected assembly, depending on the equipment selection and local conditions at the project site. Part of this differential results from maximum utilization of standardized manufacturing procedures. In some areas, high labor costs further militate against field erection. Thus, each project should be individually evaluated because factors such as load characteristics and operating costs will influence the economic balance. But the trend toward preassembly continues strong and will undoubtedly increase as additional designs not previously consid-



Superior Combustion's fire tube unit illustrates four-pass construction. Design uses induced draft operation.



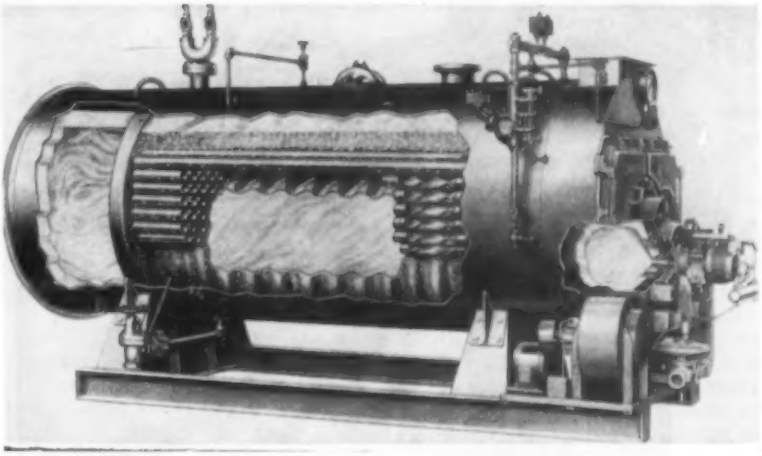
ered within the packaged field are released on a pre-erected basis.

Fire Tube Boilers

Scotch marine boilers (combustion chamber within the boiler shell) are well known to power engineers. Recognized as rugged, reliable, easy to maintain, and able to stand a considerable amount of abuse, these units remained unchanged in basic design for many years. Ultimately, modifications using multipass construction with smaller fire tube diameters and incorporating control of both the high velocity flue gas travel and waterside circulation were introduced and marketed as completely self-contained packaged boilers.

Capacities in the modified Scotch marine design extend from approximately 15 hp to 600 hp. Available units include the conventional two-pass with settling sump below the combustion chamber, and various modified multipass types with tubes below the combustion chamber. These modified designs can be obtained in two-pass, three-pass dry back, three-pass waterback, and four-pass arrangements.

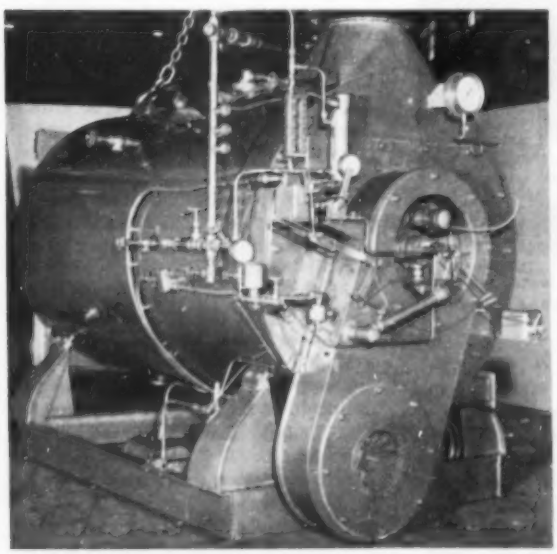
Some manufacturers are now shop-assembling modifications of single and two-pass horizontal return tubular boilers (combustion chamber outside of the boiler shell), both with and without water cooled walls. Single unit capacities with these HRT designs are restricted by the additional height caused by the external furnace. However, in some larger sizes the assembly will consist of two pieces, one of which is a steel encased base containing the refractory lined combustion chamber, rear bridge wall, firing equipment, and controls. The other assembly contains the pressure parts with extended casing, flanged at the bottom for connecting to the base.



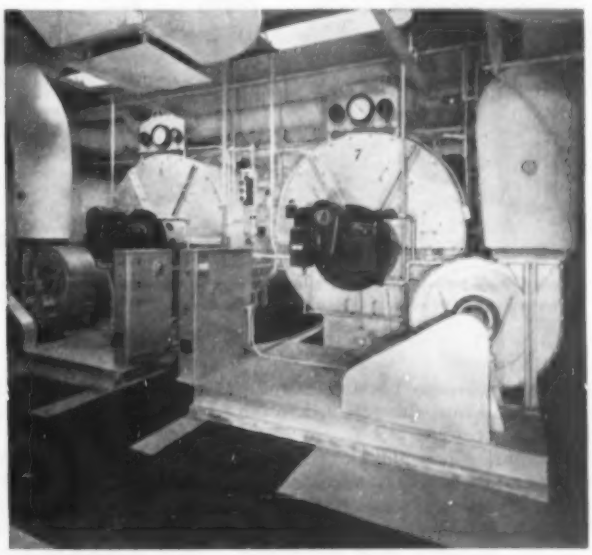
A conventional two-pass Scotch type Kewanee boiler and a Ray forced draft burner are the principal components of this integrated boiler-burner unit.

Divided opinion has arisen among the various boiler manufacturers on the manner in which the customer's interests are best served. Several companies now produce what is termed a boiler-burner unit, which is integrated in engineering detail but not preassembled. The boiler, a conventional two-pass Scotch type unit with normal boiler trim, constitutes one shipment, while the burners and controls constitute another. Both parts are arranged for fast connection at the job site.

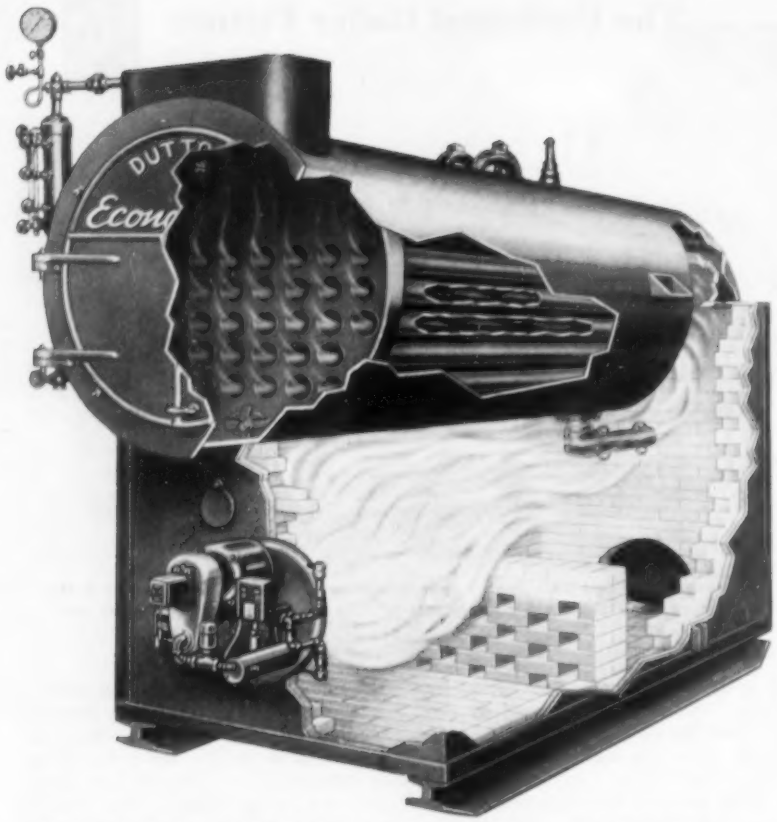
Proponents of this design claim that factory assembly and test serve



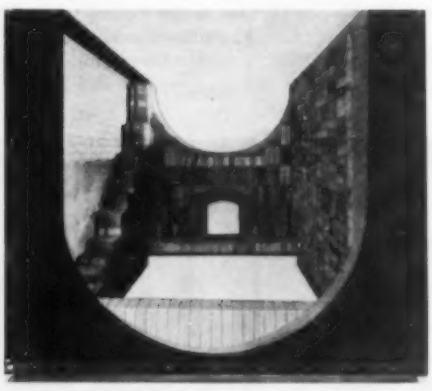
Shop photo shows a Cyclotherm steam generator, ready for shipment. Unit is modified two-pass construction.



Preferred Utilities' induced draft design offers four-pass gas travel. These two 150 hp units burn No. 6 oil.



Packaged, single-pass HRT boilers, such as this Hapman-Dutton Economist, are available for oil or gas. With separate subbase, units can burn solid fuels.



Erie City's two-pass HRT boiler can be obtained with or without water walls. Photos show pressure element and separate, refractory lined furnace section.

no useful purpose because burners and controls must be adjusted to the individual project conditions after installation. They point out that on new projects the boiler can be installed at an early stage of the construction while the burners and controls can be added after the building is enclosed. Both the boiler and the burner manufacturers assume responsibility for the complete installation. The arrangement does give the purchaser some flexibility in selection of firing equipment if he has a preference for a particular type of burner or control system.

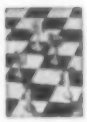
Naturally, those manufacturers who produce both boilers and burners prefer the completely packaged arrangement. Their arguments include the value of adjustment of burners and controls and the advantage of the preliminary firing test at the factory of the boiler, burner, and all controls — as a unit. They will point out that this self-contained unit is the true packaged boiler — where responsibility for proper initial operation of the boiler and burner lies with one manufacturer.

Methods of Rating Output

To further complicate the situation, the self-contained and so-called semipackaged designs each use different systems in rating the output, and each is at variance with the normal listings of water tube boiler capacities. Self-contained packaged automatic boiler manufacturers utilize the ASME system for specifying heating surface. With this system, the heating surface is measured on the side receiving the heat, which on a fire tube boiler is the internal or smaller diameter surface. Manufacturers of boiler-burner, conventional two-pass Scotch marine units, on the other hand, conform to the standards of the firebox boiler industry and publish their heating surface according to the Steel Boiler Institute system. This method specifies measurement on the side of the largest diameter, or external water side, on fire tube designs. It is obvious that the difference can be appreciable, particularly on the larger units. Water tube units are rated by the ASME system, capacities being listed in lb of steam per hr. In the interest of all concerned, some standard basis should be established that also would include the water tube designs.

Some engineers point out that the only theoretically correct system is the one which rates the heating surface based on the side receiving heat. This is because the effect of either the metal conductivity or the water conductivity in the heat absorption of the boiler is so small as to be completely negligible. The resistance to heat flow of the gas film is so much greater than these other items that it takes complete control. Therefore, the heating surface must be figured on the gas coefficient to be theoretically correct.

Most performance catalogs also list capacities in terms of pounds per hour which, for the sake of uniformity, usually are calculated on a from-and-at 212 F basis. Some tables list an operating pressure and specify the feedwater temperature (generally 212 F). This also can cause confusion if the specifications are at variance with the actual operating conditions. To assist engineers in



evaluating the potential of various designs and the capacity that can be expected, a chart is included showing the effect of feedwater temperature and operating pressure on steam output.

In the future, the boiler industry may establish some standard basis for measurement that will apply to all types of steam and hot water generating equipment, probably the most likely candidate being the Btu. This would eliminate the variables and establish a basis for uniform evaluation. Only the magnitudes involved would be a deterrent. However, some authorities have experimented with symbols for units of 1000 and 1,000,000 Btu. The need is evident, and with greater realization of the fact that modern boilers are simply heat exchangers, added emphasis may be placed on methods for standardizing ratings.

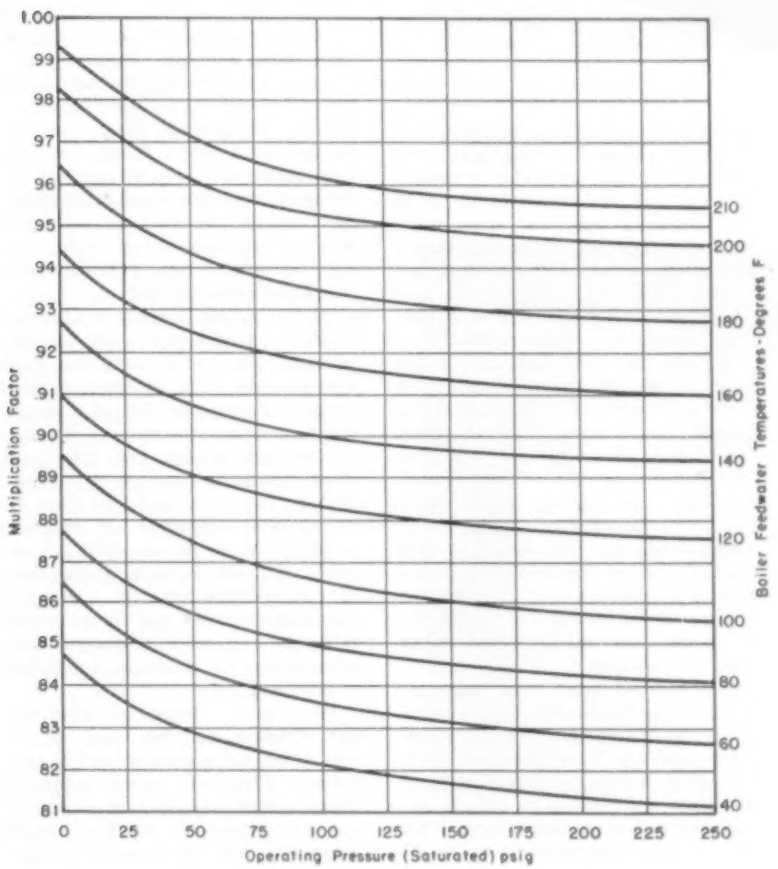
Fire tube manufacturers report that in recent years there has been a considerable increase in the number of units sold for gas firing. At present gas (generally in combination with a standby fuel) represents approximately 1/3 of the total sales volume. The standby fuel is determined principally by service conditions, varying from light oils, where there is very little danger of extended service interruptions, to the heavier residuals, especially for large units or where operation on oil firing may be sustained for long periods. Some plants that maintain a standby bulk propane supply as an alternate fuel to natural gas used in process operations have applied these reserves for firing packaged steam generators.

Fuel Supplies

Although utilization of natural gas has increased markedly, some manufacturers believe that consumption has momentarily reached a plateau. More consumers want natural gas it is true, but distribution systems are not keeping pace with the demand. The problem is partly geographical, being most acute in areas remote from supply sources where low pressure may increase costs. This factor must be considered when selecting the type of fuel and firing method.

Heavy oils continue much in demand, particularly for the larger installations. This has created numerous problems, as the oil industry has introduced reclassifications which have brought changes in the quality of both the No. 5 and No. 6 oils. Some years ago, there were No. 5 oils available that were popularly called "cold No. 5" because they could be burned without preheating. Such fuel is now available only in certain geographical locations, and almost all manufacturers insist on the installation of preheating equipment for anything heavier than a No. 4 oil.

Some manufacturers very carefully screen the end usage of their product to determine suitability of

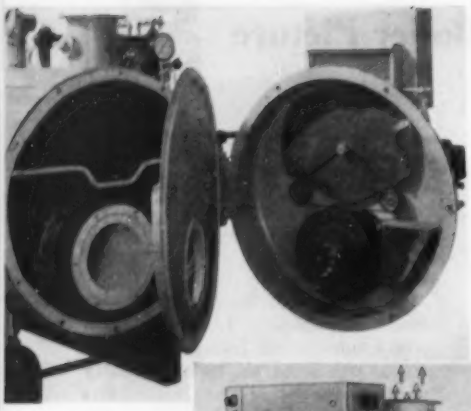


EQUIVALENT RATINGS

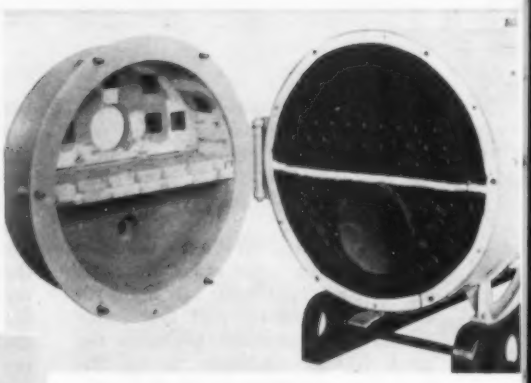
Boiler horsepower	Lb per hr capacity*
15	517
20	690
30	1035
40	1380
50	1725
60	2070
70	2415
80	2760
90	3105
100	3450
150	5175
200	6900
250	8625
300	10350
350	12075
400	13800
450	15525
500	17250
550	18975
600	20700

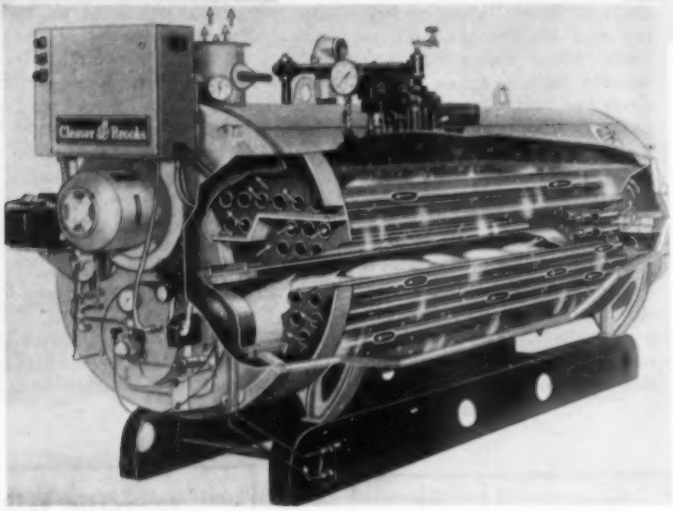
*From and at 212 F.

Left. Chart lists capacity correction factors for various boiler feedwater temperatures and operating pressures.



Cleaver-Brooks recently developed hinged front and rear sections for the small sizes in their self-contained fire tube boiler series. This new arrangement facilitates inspection and service.





the suggested fuel. This includes not going below certain horsepower ratings with the heavier oils, and also insistence on the lighter oils for all projects that will be relatively unattended. The reasons are obvious, especially for projects with intermittent operation on residuals where the maintenance of constant oil temperature introduces a variable that must be closely controlled.

No fire tube boiler manufacturer reports an extensive demand for coal firing. Research organizations have spent a considerable amount of money during the past four years trying to develop a stoker for packaged units but thus far have been unsuccessful. Experimentation with pulverized fuel also has failed, and for the moment at least, most engineers concede that the small plant, packaged boiler market is confined to liquid and gaseous fuels.

Design Changes

While actual physical differences in the outward appearance of fire tube boilers are relatively small, many modifications have been made to improve the designs. With any packaged unit the over-all size must be such that it can be shipped on a standard railroad or highway carrier. This limits the width to roughly 11 ft and the height to about 13 ft. The only way that most units can be expanded is longitudinally, and since current 600 hp units approach 30 ft in length, the ultimate maximum, from a practical standpoint, has been about reached.

Among the new features in fire tube designs is the use of hinged front and rear heads on some of the popular, small sizes. The rear head contains all of the baffling and rear combustion chamber refractory, with asbestos tape sealing the multiple gas passages at the hinged joint. These heads are of massive cast steel construction, as the tendency in the field is to continuously improve the quality of all equipment to handle the severe service to which many units are subjected.

In the front head, new arrangements of the mechanical draft equipment, including heavy aluminum fan impellers, air passages with acoustical linings, and the stability of weight are serving to greatly reduce the operating noise level. This has been one important factor in all types of packaged boilers that has demanded additional consideration. More and more evidence indicates manufacturers are doing everything possible to reduce fan and burner noise to a comfortable standard, and are getting very acceptable results.

Most manufacturers are upgrading the quality of their product to match that of larger, industrial type construction, as they feel this is warranted regardless of the service conditions. In short, most designs no longer approximate domestic or commercial construction but are physically stronger, heavier, quieter, and more reliable. Optimum performance is obtained throughout the operating range, with efficiency averaging 80 percent from one-third to full load when firing fuel oils. The hydrogen to water reaction accompanying natural gas firing slightly reduces the average efficiency, but manufacturers are taking this into account when publishing revised performance data.

While many arrangements are used to provide the most intimate possible contact between the gases and heating surfaces, there is little thought in the industry of attempting to increase the amount of transfer surface in the fire tube unit. Most manufacturers use a standard of 5 sq ft per hp and feel they are giving the consumer an excellent product within the available physical limitations. Sustaining adequately conservative transfer rates and reasonable outlet gas temperatures is considered more important than attempting to increase individual unit capacities.

There is also little likelihood that any attempt will be made to increase the top pressure for fire tube boilers. First, the added weight of the physical construction would be out of proportion to the results achieved. Second, demand is pri-

marily in the 100 to 150 psig pressure range. Occasionally, an operating condition will necessitate the use of a separately fired, external superheater, but such installations are exceptional. Superheaters and heat recovery equipment do not frequently find application in the fire tube field.

Much of the progress in design and construction can be attributed to modern manufacturing methods. Most shells are of welded construction, and units for steam pressures above 15 psig are X-rayed and stress relieved after fabrication. Manufacturers have set up special equipment for drilling tube sheets and rolling tubes in a standardized sequence to assure a uniformly high quality product at minimum cost.

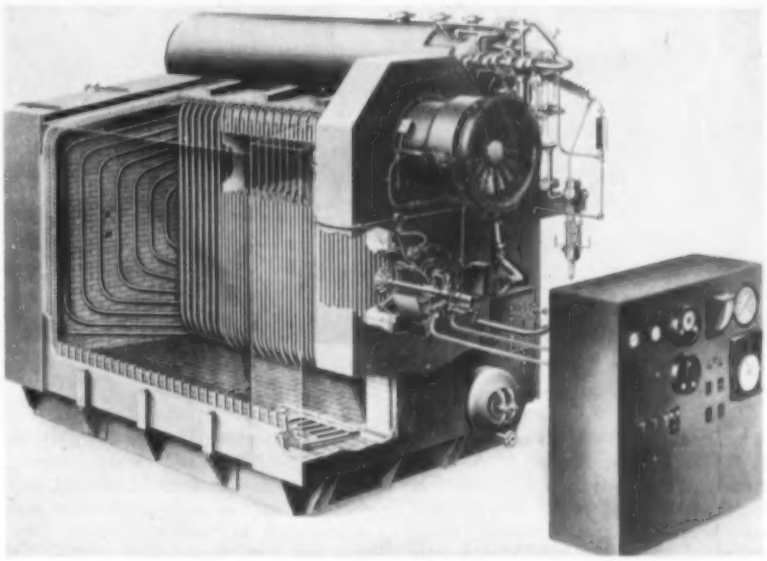
Water Tube Boilers

Although somewhat newer as a specific entity, water tube units are becoming increasingly important in the packaged automatic boiler field and are giving comparable performance over a much wider range of service conditions than can be obtained with fire tube units. Some manufacturers seem to partially resent the package label and stress the fact that units currently available are simply modifications of standard, accepted designs with proven performance records. Inspection of the principal drum and tube arrangements, as illustrated, give credence to this viewpoint.

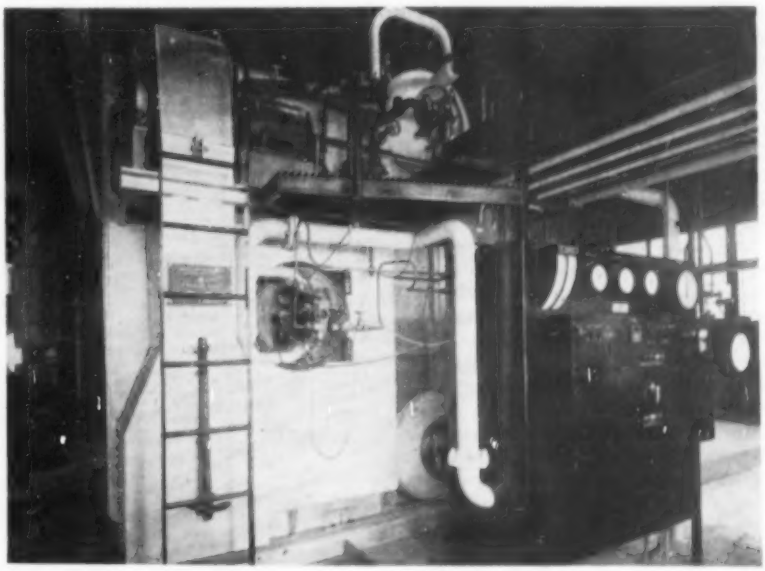
Published capacities in the water tube field range from approximately 2500 to 40,000 lb per hr in single units. Over-all physical dimensions are somewhat larger than those listed for comparable fire tube designs, but water tube boilers have the advantage of spanning the complete pressure range up to 900 psig. Drum internals provide effective moisture separation, and steam quality generally surpasses that of fire tube designs. In addition, most water tube units can be equipped with integral superheaters of either the drainable or pendant type.

At present, the majority of water tube manufacturers utilize a vertical, two drum arrangement at one side of the unit. A series of continuous tubes, running from the top drum to the lower drum, form the roof, side walls, and floor of the furnace. This design is probably the least expensive to build because the incorporated weight is less than in other standard types. Furnace width is the limiting characteristic, and as currently constructed, this unit can be used only for oil or gas firing. Coal firing would mean modifications such as eliminating floor tubes and increasing furnace volume.

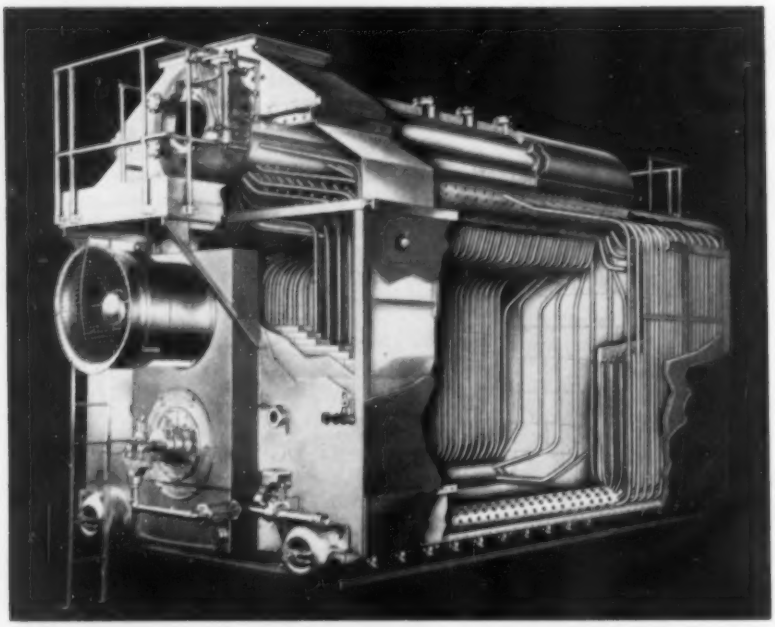
All of the other standard designs also use a single longitudinal steam drum, centered at the top of the unit, but they differ appreciably in the arrangement of the lower drums and water wall headers. One type has two lower drums, one on each side, to serve identical banks of generating tubes on each side of the furnace. A second design also uses a divided tube bank, but all tubes



A series of continuous, two-inch tubes form the roof, side walls and floor of the furnace in Babcock & Wilcox's self-contained steam generating unit.



This 20,000 lb per hr Combustion Engineering packaged boiler is installed in a manufacturing plant. Unit is arranged for natural gas and oil firing.



Union Iron Works uses two lower drums, one on each side of the furnace, which serve identical generating tube banks.

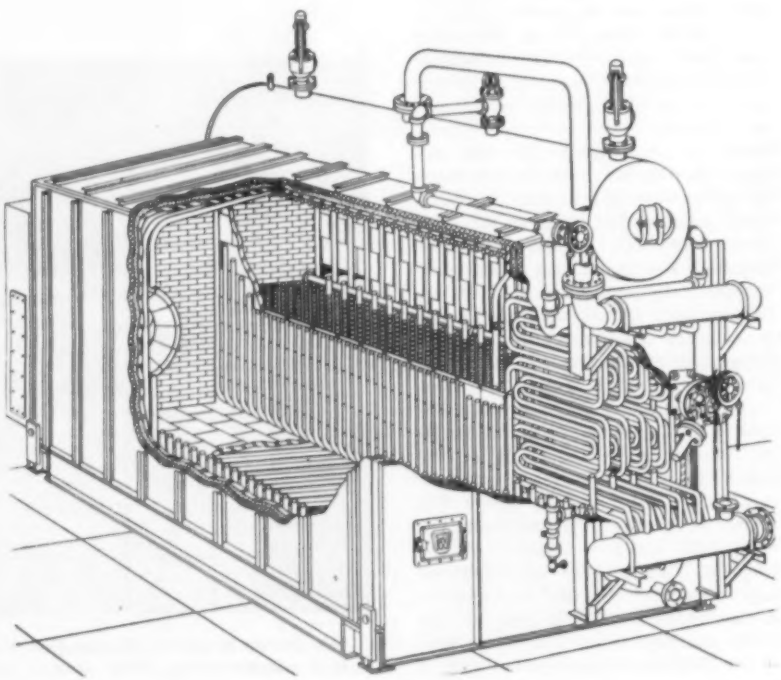
enter a single water drum centered at the bottom of the unit. A third arrangement utilizes symmetrical water wall headers in the furnace area and a single, centered, short lower drum behind the bridge wall in the convection section.

Rear or target wall cooling is provided on all units having full length furnaces. Some manufacturers have modified their designs to include several rows of tubes in this area and use welded clips between the rows to increase the structural stability. Front wall cooling also is gaining favor although some designers do not consider it necessary. Other variations include rearrangement of tube patterns to improve gas flow between the furnace and generating tube bank.

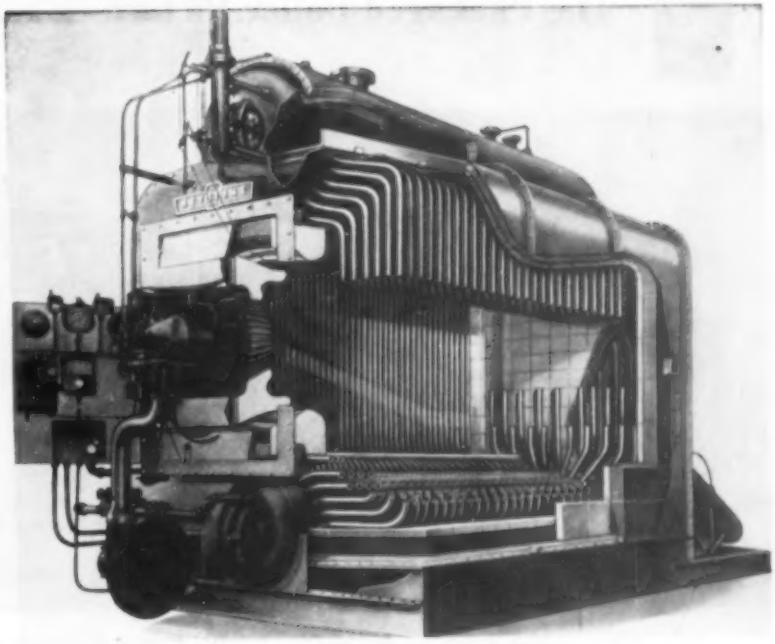
All water tube manufacturers recognize the necessity for proper feedwater conditioning. The industry standard is a two inch diameter tube, and with the transfer rates commonly used, clean surfaces are essential. The answer is carefully controlled water treatment to minimize maintenance and to sustain design performance. Negligence can cause trouble, as some modern bent tube arrangements are difficult to clean mechanically. Some companies advocate chemical cleaning, and this method has proved effective and economical in both the water tube and fire tube fields.

For a given rated capacity, most water tube units actually utilize less surface than many fire tube units. In terms of the old standard of 10 sq ft per hp as equivalent to a 100 percent rating, the modern water tube boiler operates in the neighborhood of 250 to 330 percent of rating, or somewhere between 3 and 4 sq ft of surface to a horsepower. This again illustrates how obsolete current terminology has become, since the most important factor in modern water tube design is the amount of incorporated surface in the entire system, including heat recovery equipment. Currently, the limiting factor is not the design problem of including enough surface but rather that of getting the proper combination furnace and burner arrangement which will provide the fundamental requirements of time, temperature, and turbulence with the end result that flame impingement, furnace wall slagging, and aperture slagging will be avoided.

Military specifications covering water tube designs ask for a maximum release of 54,000 Btu per hr



Rear cutaway view of a Foster Wheeler unit illustrates a typical arrangement of water tube boiler with superheater.



Erie City's Keystone design has divided tube banks, with all tubes terminating in one drum at the bottom of the unit.

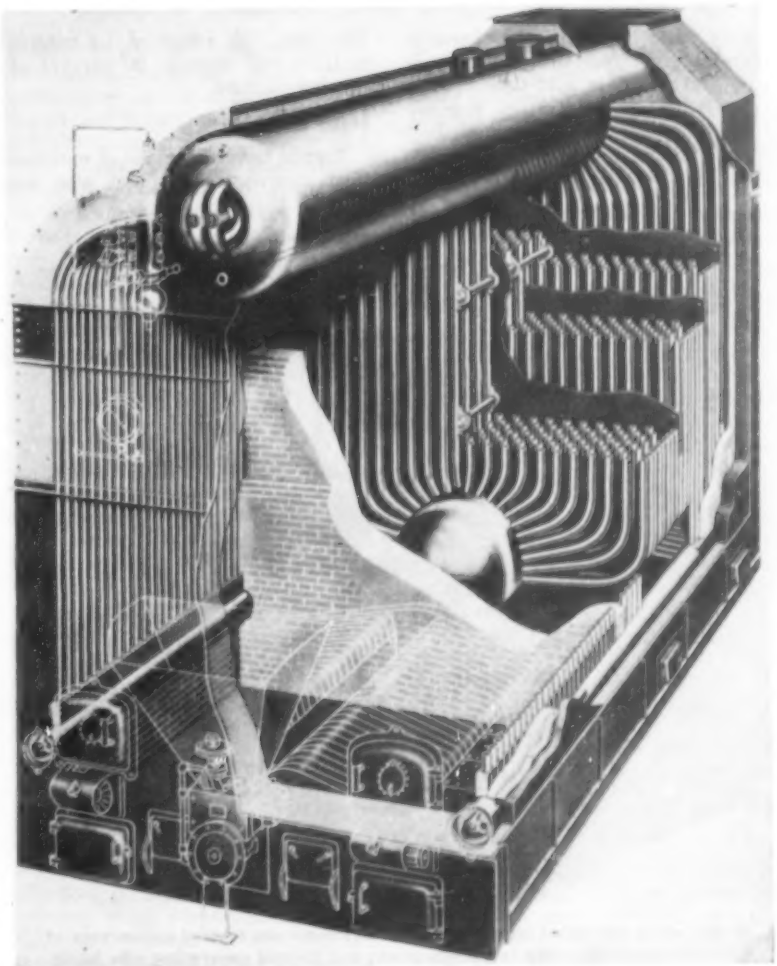
per cu ft of furnace volume, and some manufacturers feel liberation rates of approximately this magnitude are satisfactory at the present time. Other manufacturers report successful industrial applications at much higher release rates. As the trend to larger capacities in single units increases, some engineers believe values of heat release may approximate 100,000 Btu per hr per cu ft of furnace volume. Such procedure would place even greater emphasis on feedwater conditioning.

Range of Application

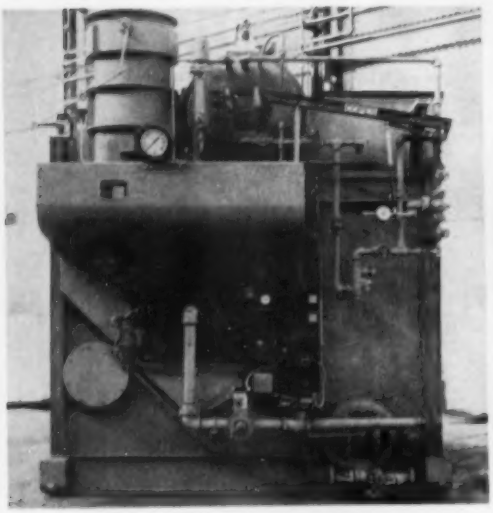
The range of application of water tube units covers a wide area. Some manufacturers report the majority of their sales are in the 100 to 200 psig pressure range, while others report sizable increases in the demand for higher pressure — higher temperature units. The first installation of a multiple number of high pressure packaged water tube boilers now is being made for power generation. For such specialized applications, the manufacturers even incorporate superheat control similar to arrangements commonly used in the utility field. A conservative estimate would be that almost 20 percent of current production includes superheaters.

Both axial flow and centrifugal forced draft fans are widely used for packaged boilers, with many of the designs utilizing pressurized firing. Centrifugal fans predominate on fire tube boilers, while the majority of water tube installations are equipped with axial flow fans. Since most forced draft fans are installed at the front, noise is a consideration and much study is being devoted to reducing it. On some designs, the axial flow fans have been elevated and supported on the upper part of the burner windbox so the air inlet is at an angle to or facing the ceiling. Thus, the inlet air noise is well above the working floor level. Elevated mountings also are utilized on units with centrifugal fans, and both direct connected and V-belt driven arrangements are available. Some designs are arranged for induced draft operation.

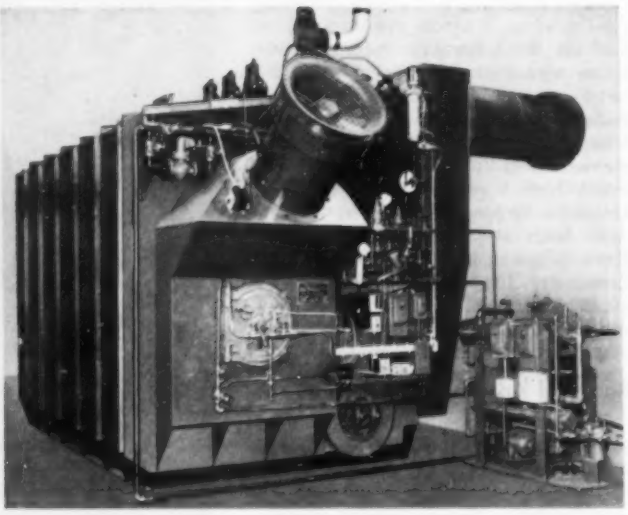
With the advent of modern wide range burners, precise control of the



Keeler offers an assembled oil and gas fired unit similar to their CP design (shown here with field-erected stoker).



Titusville's shop-assembled boiler is designed for forced draft, pressurized furnace operation.



This Bigelow packaged water tube boiler has a rated capacity of 17,500 lb per hr. Pump and heater set is separately mounted.

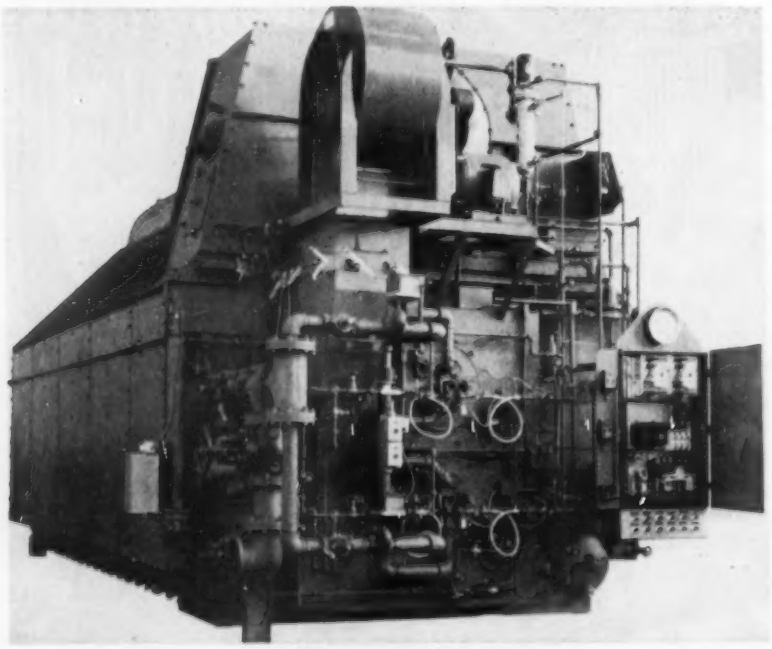
forced draft fan output has become increasingly important. Air flow is proportioned to fuel flow by the combustion control system, regulation generally being accomplished by positioning a standard vortex design of inlet damper. With axial flow fans, the range of air control is from full open to 90 percent of damper closure.

Heat Recovery

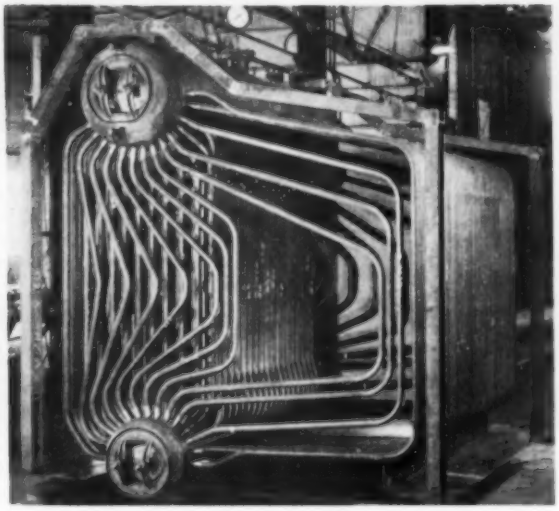
Trends toward the use of external heat recovery equipment also are strongly evident. Packaged type air heaters and economizers are available and are being supplied on approximately 10 to 20 percent of the installations. Of these, economizers find the widest application because of their greater flexibility over the extended load ranges encountered on so many jobs. Certain service conditions necessitate the addition of bypass arrangements for low load operation with air heaters, and this requires control cycle modifications.

With heat recovery equipment most plants require forced and induced draft fans. Both two fan arrangements and duplex systems, whereby the forced and induced draft fans are mounted on one shaft with a single drive, have been applied with success. Generally, such mechanical draft fans are not mounted with the boiler unit, particularly in the larger sizes. However, the necessary air and gas ducts can be shop-fabricated and prefitted to facilitate assembly at the job.

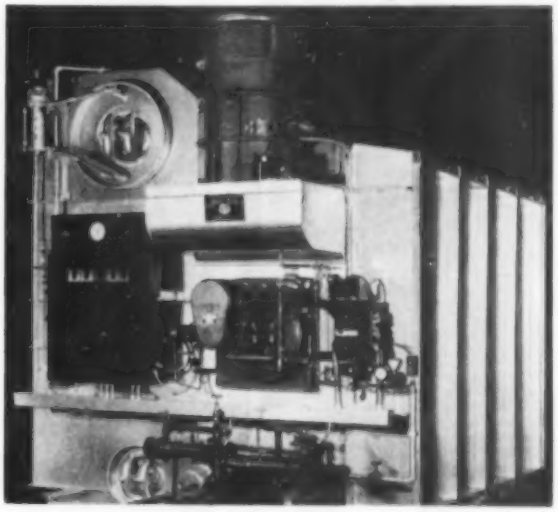
Most water tube boiler manufacturers report gas firing is extremely popular, in about the same proportions as reported by the fire tube manufacturers. Heavy oils continue strong, and there is some demand for equipment to fire coal or solid waste products. Coal firing does have some chance of invading the water tube field, but modifications will be required, especially in designs utilizing furnace floor tubes. One prime requisite for any coal



Wickes' shop-assembled steam generator illustrates the typical appearance of a water tube design using two lower drums and divided generating tube banks.



Springfield utilizes water cooling on both the front and rear walls. Rear wall tubes are in multiple rows.



Modified designs can provide both HP-HT hot water and steam with the same unit. Springfield's boiler is shown.

fired arrangement would be the incorporation of self cleaning features in order to provide anything approximating automatic operation.

Additional furnace volume will be the principal consideration in the development of equipment for coal firing. Some designs already can achieve the desired result by physically elevating the standard unit and installing a stoker fired furnace beneath it. These include water tube units with multiple lower drums or with bridge walls in front of a single drum, and even the modified HRT in the fire tube field. The vertical unit design with side furnace, however, probably would require terminating the side wall tubes in a header and modifying the structural arrangement. Research on the problem is progressing, but at present there is very little likelihood of a coal fired unit in packaged form.

Manufacturing procedures in the water tube field are as well standardized as those in the fire tube industry. Some manufacturers build only a few standard models to encompass a series of pressure ranges, while others can furnish equipment for any specified pressure. Most of the larger manufacturers use a single profile facing the front of the unit and vary only the unit's depth to obtain capacity increments. Other manufacturers have established dimensional standards for a series of front profiles. This procedure is based on the premise that in the smaller capacity units, increasing the length and reducing the other dimensions assures better flame travel and provides greater flexibility in furnace design.

All manufacturers exhibit a strong tendency toward the use of tangent or extended surface tubes in the furnace area. Both arrangements not only increase the amount of radiant surface but reduce the need for refractory materials. Rows of tangent or extended surface tubes are serving as internal baffles and, in some instances, the entire external surface of the furnace.

Water Tube Settings

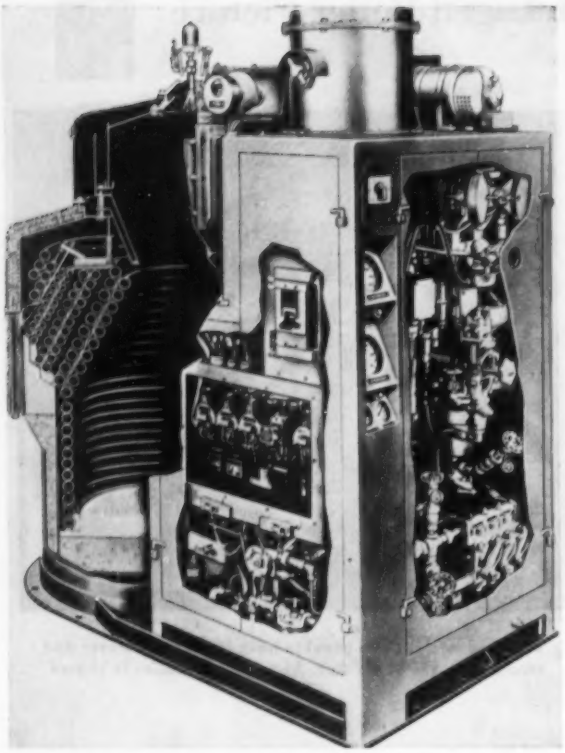
Possibly the greatest design differences in water tube boilers are in the arrangements of the settings and the utilization of refractory and insulating materials. This may be due to the fact that one of the earlier difficulties with packaged units was refractory breakage during shipment. Corrective measures in the form of better anchoring methods and controlled application of refractories have practically solved this problem.

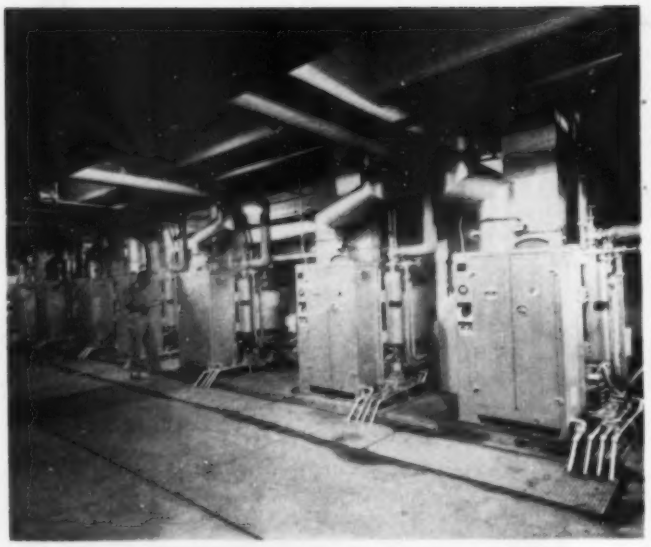
Both refractory tile and castable materials are being used extensively in front walls, target walls, and furnace floors. Four-way, shiplap refractory tiles have found application in straight baffles and some exterior walls, while poured monolithic construction is employed for cross-tube baffling. Typical outside wall constructions range from refractory tiles over standard spaced tubes covered with high temperature insulating block, blanket insulation, and casing to a small amount of plastic refractory or an asbestos millboard backing up tangent or extended surface tubes and covered with block insulation and casing.

One design eliminates all side wall refractory and utilizes a double casing construction with insulation enclosed between two steel panels. This arrangement features casing removal without disturbing the insulation. The panels are welded to clips on the upper drum and structural supports, spaced at convenient intervals. Stainless or alloy steels are used at the high temperature areas of the unit, and low carbon steels are employed in those locations where the temperatures have dropped low enough to permit use of this material.

Reinforced casings with welded joints are standard on almost all designs. This construction is required to prevent air and gas leakage with pressurized firing. One recent innovation is the incorporation of provisions for draining entrapped moisture, in the event of a tube failure, without destroying pressure tightness of the setting.

As with fire tube units, the degree of completeness of water tube packages varies greatly with the different manufacturers. Not all packaged units are completely closed, and in





Selective controls provide automatic operation at this multiple unit installation of Vapor-Clarkson generators.

Vapor-Clarkson flash type steam generators can develop 200 psig steam pressure in two minutes from cold water.

some instances, the purchaser must provide additional refractories and field labor to finish off the unit. In analyzing the various packaged units now available, the purchaser must carefully check their completeness as to setting enclosure, furnace brick walls or lining, and insulation. The extent of required foundations and the auxiliaries included as standard equipment also must be investigated.

Water tube efficiencies are comparable with those achieved by fire tube designs for most applications having relatively high sustained loads. The fire tube unit probably achieves slightly higher efficiencies where low loads are carried for extended periods or on intermittent service conditions. While performance is excellent for most applications, the water tube manufacturers find an increase in the number of installations where there is need to sustain even higher efficiency through the use of heat recovery equipment. All designs naturally require the maintenance of clean transfer surfaces to assure sustained efficient performance.

Small Steam Generators

For many specialized applications, both flash and controlled recirculation type units will give excellent service. In the flash type steam generator, cold water enters one end of a set of continuous coils, and steam is discharged to a separator at the other end. The total water pumped into the coil is from 105 to 110 percent of the output, the excess water serving to carry soluble salts and precipitated sludge out of the coils. This water is removed from the steam in the separator and discharged by blowdown or returned through a heat exchanger to the feedwater tank.

Units of this type offer an absolute minimum of physical size for the output achieved, the heat release being 1,000,000 Btu per hr per cu ft. Working steam pressures can be produced from a cold start within a matter of minutes, which makes the unit particularly adaptable for applications where small quantities of steam at relatively high pressures are required intermittently. Capacities generally range up to approximately 5000 lbs per hr in single units. Higher outputs necessitate the use of a multiple number of units, and such installations are furnished with servo controls that automatically cut units in and out of service as the load changes.

Forced or controlled recirculation type steam generators also utilize a single passage continuous coil, and flow is proportioned to this steam generating tube to provide a high velocity. The basic difference is the total volume forced through the unit, which is as much as 10 times the steaming capacity. Steam is taken off at a steam separator, and the balance of the water drops to the bottom of an accumulator where it is picked up by a positive displacement or centrifugal pump and recirculated to the heating cycle. Water capacity is relatively low in terms of output, normally approximating only 10 to 15 percent of the hourly evaporation under full load.

Technological progress has contributed materially to the developments in this small steam generator field. New heat resistant alloys (32 different metals are used in one unit) have increased the design possibilities, even leading to experimentation with external, separately fired superheaters patterned after the basic generators. Manufacturing operations are on a full assembly line basis including the final fire testing and adjustment.

In continuous coil designs, water treatment is again an important consideration. Some units use graduated coil sizes in the various sections of the unit but the diameter is always considerably smaller than the tubes in a standard water tube unit. The generators must be cleaned chemically, and external circulating connections are provided for this operation. Most manufacturers recom-

mend zeolite softening as they feel it helps lengthen the interval between washouts.

Hot Water Service

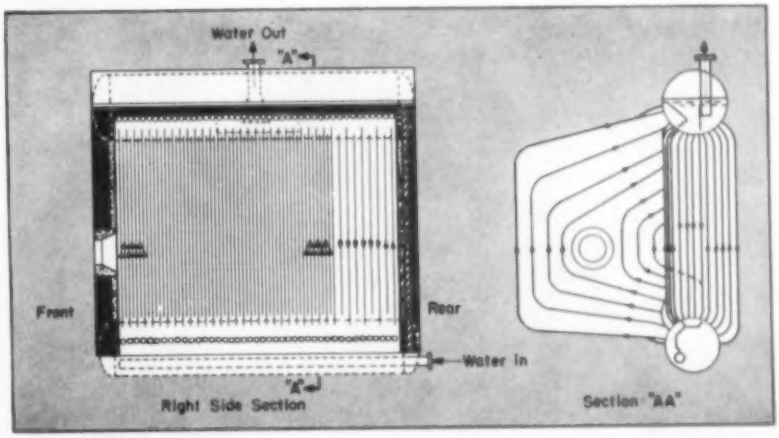
One major trend reported by all manufacturers of all classes of packaged units is the increasing number of hot water installations. Hot water systems for heating, and even certain process operations, save considerable initial investment through the utilization of smaller pipes. Furthermore, appreciably less heat is required to obtain desired results.

Several basic arrangements are employed. All water tube, fire tube, and controlled recirculation designs are operating satisfactorily as straight hot water boilers. Many units can be used for either low pressure water or steam production depending on seasonal requirements. In addition, some of the water tube manufacturers use divided circuits in a modified standard boiler to achieve both hot water and steam production with a single unit.

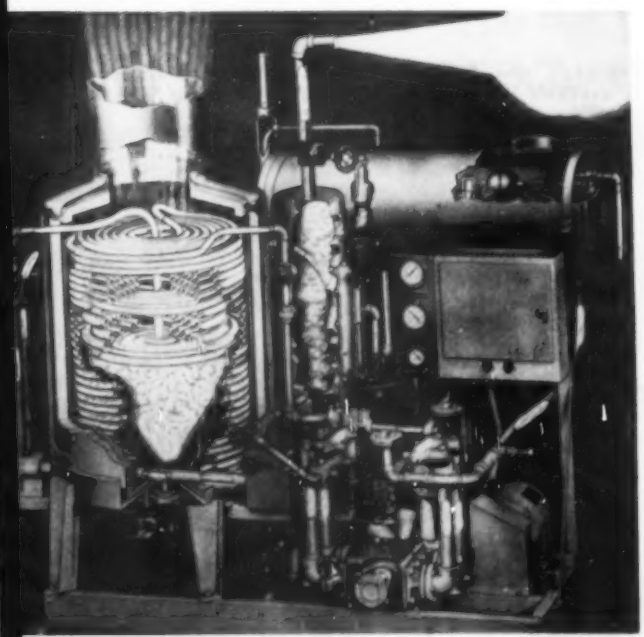
Dual Purpose Units

Dual purpose units have a first stage forced circulation section that supplies the hot water requirements. This is achieved by internal baffling in both drums which isolates the forced circulation stage from part of the generating tubes. The balance of the tubes feed the upper drum, where a normal water level is maintained. This arrangement offers considerable advantage in that the combustion control system can be actuated by steam pressure.

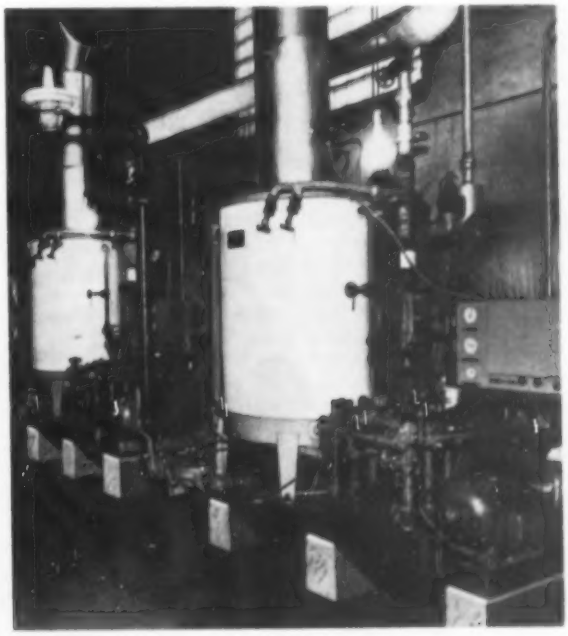
Safety provisions include the fact that if anything should occur in the water lines, the boiler still can operate under natural circulation, which would permit feeding water from the boiler section into the water walls during times of interrupted return water supply. Under normal conditions, all returned water is forced through the furnace enclosure or water wall tubes only. The baffling also is arranged so that steam cannot be siphoned out of the drum by the circulating pumps.



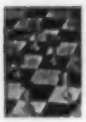
This drawing shows the arrangement of baffling and the water circulation in a Springfield unit designed for high pressure-high temperature hot water service.



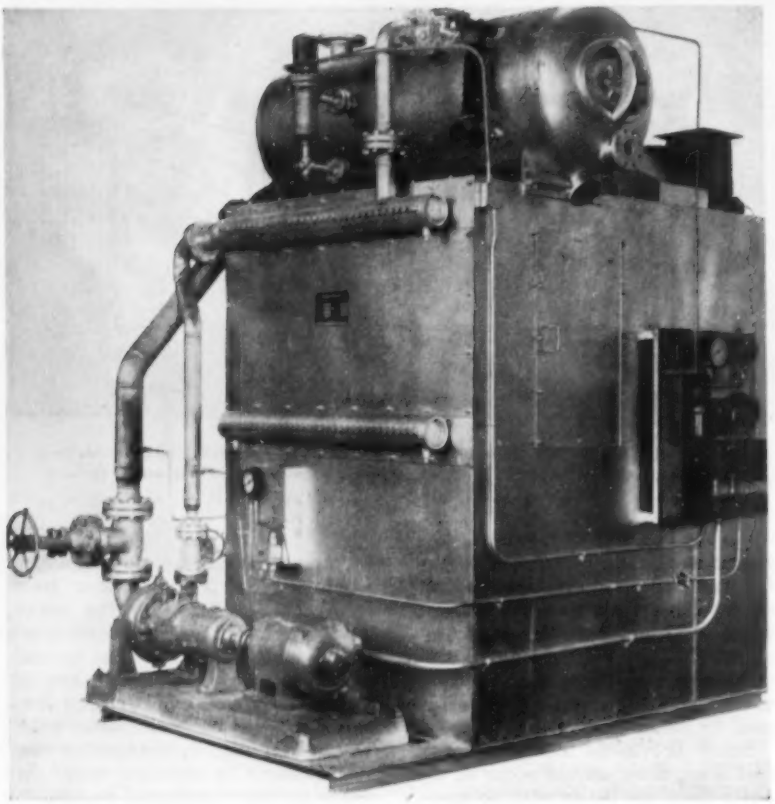
Clayton utilizes a forced recirculation and counter flow system, with integral hot well for makeup and returns.



These three, 100 hp Clayton forced recirculation units supply the steam for a dairy in East Liverpool, Ohio.



The Packaged Boiler Picture



Design pressure of this International-LaMont forced recirculation Dowtherm vaporizer is 200 psig. Unit is gas fired, the burner being mounted in the rear.

Modified arrangements of some forced recirculation and water tube designs also provide excellent service for vaporizing thermal liquids to achieve high temperature without the correspondingly high pressure. Dowtherm, Aroclor 1248 and 1254, and the various heat transfer oils are used extensively. These applications again emphasize the extreme utility furnished by the current preassembled designs.

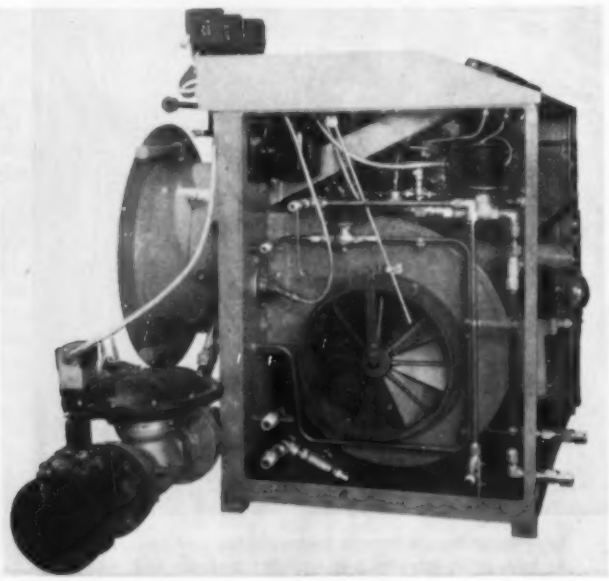
Firing Equipment

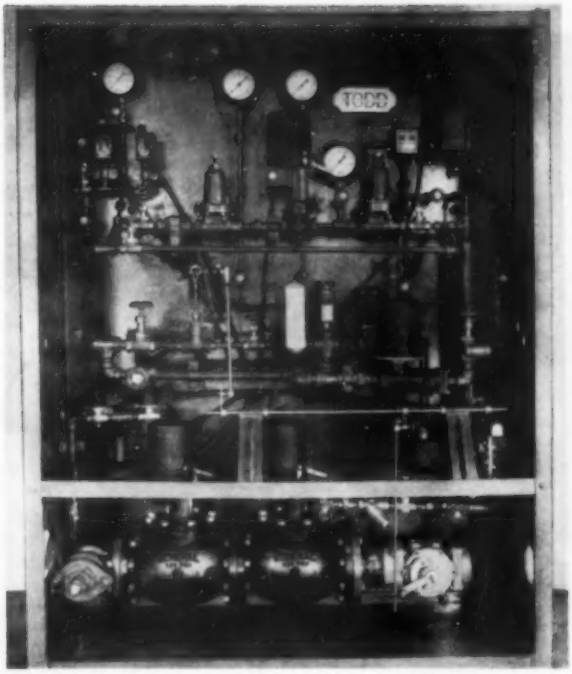
Much of the success achieved by packaged designs must be attributed to constant improvement in firing methods. Currently, there is a greater selection available in auxiliary equipment than at any previous stage in packaged boiler development. Individual project restrictions will dictate the exact method, but regardless of the conditions, equipment is available for any service.

Most packaged units utilize a single burner, although some manufacturers use two in their larger sizes. Ultimately, multiple burner installations may receive even wider acceptance as control cycles continue to develop and improve. This will be especially true as larger capacities become available in single units.

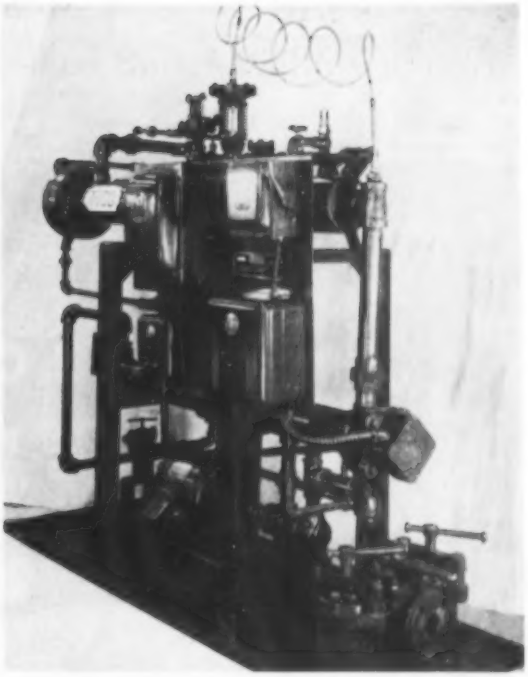
All of the normal methods of atomizing oil are being utilized suc-

Peabody's new fully automatic burner-blower assembly is available in capacities to 42,000 lb of steam per hr.





Coordination of engineering detail is well evident in this photograph showing the rear view of a Todd panel.



Todd assembly shown above is typical of the pumps and heaters supplied with heavy oil fired boilers.

cessfully in packaged designs. These include steam atomizing, mechanical atomizing, air atomizing, and rotary cup type burners. In addition, much greater attention is being paid to the arrangement of the gas burner on combination fired units, and refinements now permit changing from oil to gas (or gas to oil) within a matter of seconds.

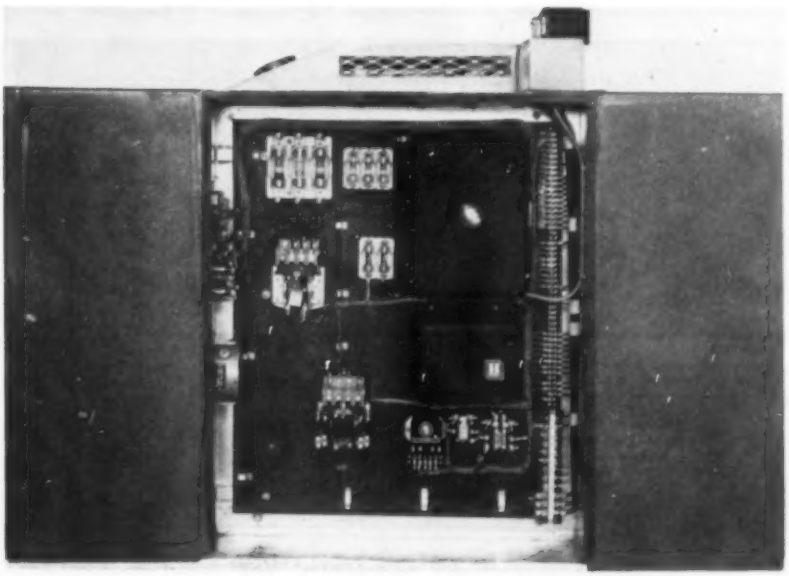
The efforts of the burner manufacturers to achieve these efficient firing methods have been prompted by several considerations. First, for automatic, partially attended equipment, a high degree of reliability is required. Second, variations in fuel quality, particularly with the heavy oils, demand considerable flexibility to avoid loss of efficiency.

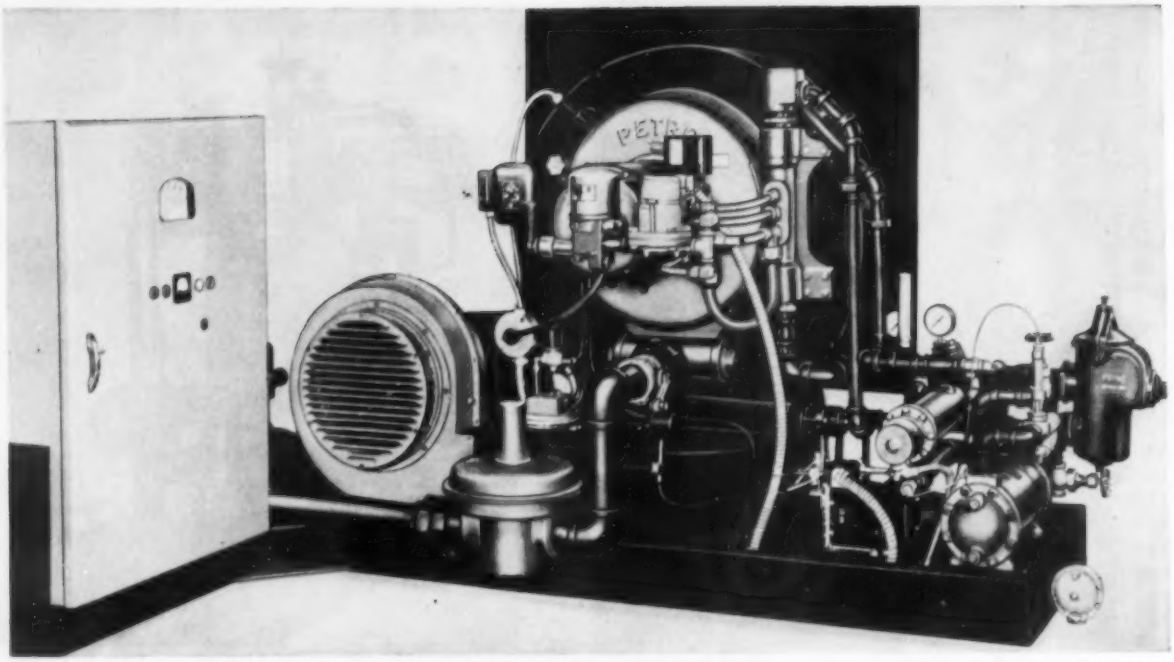
Some of the advancements that have been achieved in the past several years in burner design are illustrated, including the newest type packaged firing systems offered by the burner manufacturers. One innovation is the incorporation of the entire system of combustion, flame failure, and programming sequence controls as part of the burner-blower assembly. Again, the possibilities for standardization of manufacturing procedures plus the flexibility for diverse service requirements become apparent in these recently developed packaged burner arrangements.

Some manufacturers arrange the companion equipment for oil pumping and heating on the boiler structural supports. Where desirable, however, the burner manufacturers can supply completely assembled pump and heater sets for remote location or close coupling to the burner assembly as required. This same situation applies to control panels, which can be assembled with the unit or remotely located for operating convenience.

The exact type and arrangement of fuels will partially determine the operating cycles. In single unit installations with steam atomizing

Panels containing combustion, flame failure, and operation sequence controls may be close-coupled as an integral part of Peabody's burner-blower assembly.





Petro's burner has controls, FD fan, oil pumps, and oil heaters on one base. Assembly can be used for boiler-burner units.

burners, some provisions must be made for initial start-ups until sufficient steam pressure is developed to take over the atomizing duties. Typical arrangements include the use of light oil starting or initial air atomizing after electric heaters bring the oil to firing temperature.

In all instances, burner construction reflects the higher quality being built into the product. Minimum attention and maintenance are obviously the principal design considerations for modern automatically operated equipment. As capacities increase, demands probably will be placed on the burner manufacturers to even further increase the range of operation with a single burner to minimize on and off operation, particularly with water tube boilers.

Instruments and Controls

The second major factor that is continuously improving performance is the development of control systems. Burner manufacturers, control manufacturers, and governing insurance organizations have worked together to produce coordinated arrangements that furnish reliable, completely automatic operation, along with maximum protection.

Inspection of these latest control systems, whether of the on and off, positioning, or metering type, indicates the high degree of precision being attained by the control manufacturers. Panels are completely assembled, piped, wired, and tested at the factory. As a result, field installation material and labor are re-

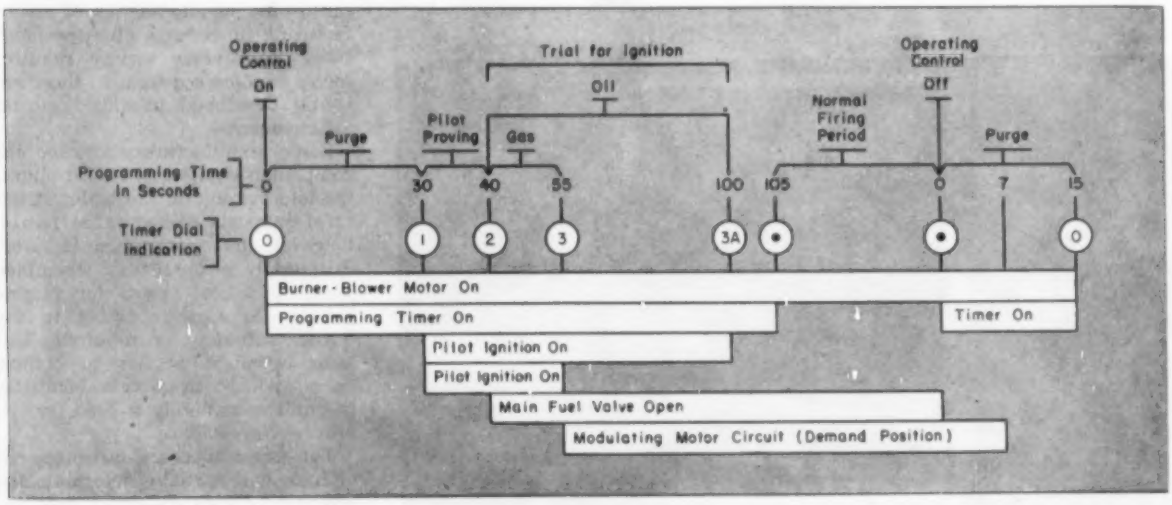
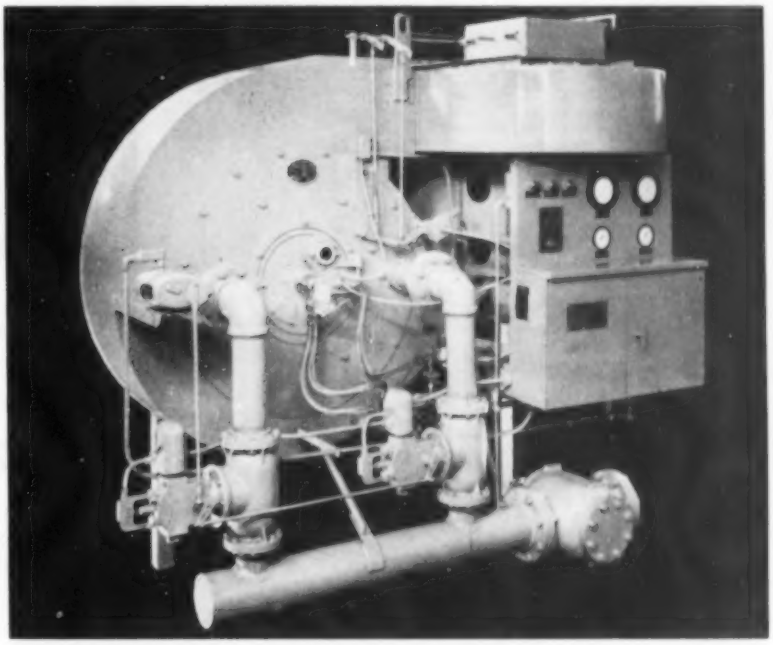


Diagram illustrates Fireye programming time intervals and sequence for packaged boiler controls with pilot ignition.

duced to a minimum. The plug-in type construction of some components, such as the master programming control, affords maximum accessibility. Standard color coded wiring simplifies field service.

Compact new photo cells now are available that provide electronic supervision of all flames, including gas pilots, in a single unit. These units are used in conjunction with reliable programming controls to accurately sequence the boiler start-up (see illustrations) and to assure complete flame failure protection. Main fuel valves cannot open unless an adequate pilot flame has been established, and when spark ignition is used the unsupervised trial for ignition period is limited to a safe interval. If the flame fails during operation, the control shuts off the fuel immediately to protect against an explosion hazard. The system cycles automatically whenever operating or limit controls close and after power interruptions but must be reset manually following flame failure. A purge period is provided before and after each firing period.



This Coen firing unit for gas and No. 3 oil serves a 250 hp water tube boiler.

Metering Type Systems

Most of the early packaged boiler installations utilized positioning type combustion controls, and this system remains popular and is effective for many conditions. Recently, however, new packaged control systems of the fully automatic metering type have been developed, and there is an appreciable demand for such equipment, particularly on water tube installations carrying high continuous loads. With this method, metering controls govern operations from the maximum rating to the minimum capacity that can be achieved with the particular burner and control setting. Below this point, the operation automatically reverts to an on and off cycle with programming by electronic controls. The steam pressure controller and the metering type fuel-air ratio controllers are equivalent to those used in control systems for large industrial and central station boilers. This system can be provided for any type of burner, and any steam pressure.

Since metering type controls assume the best possible performance

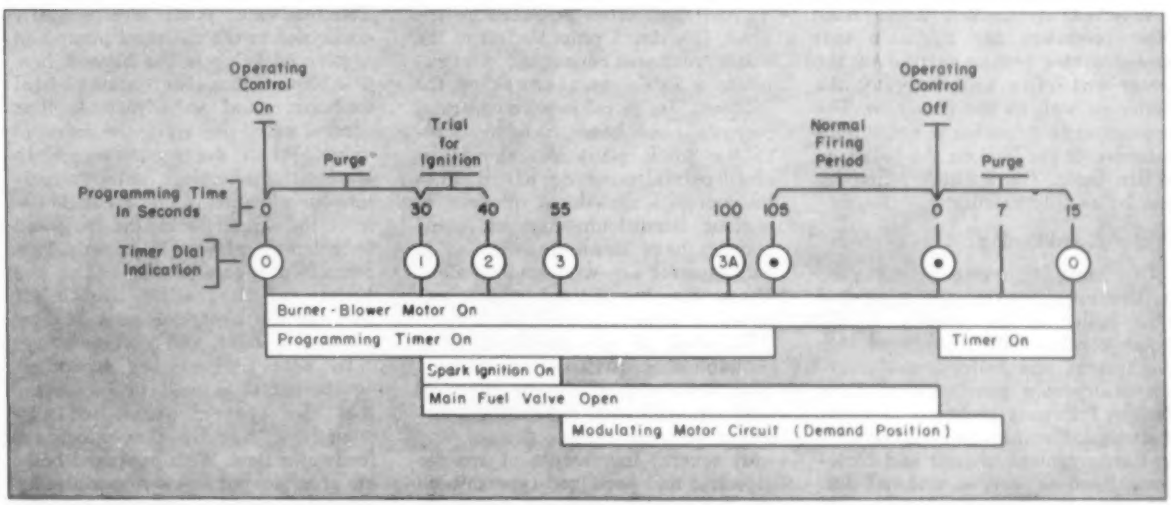
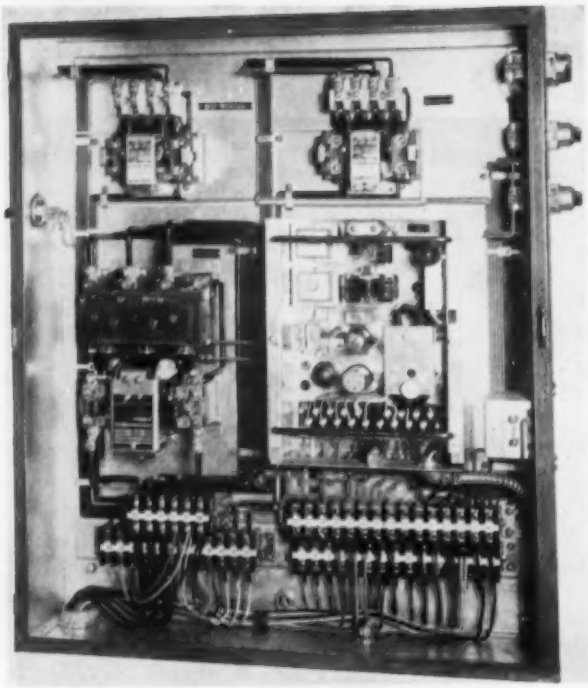
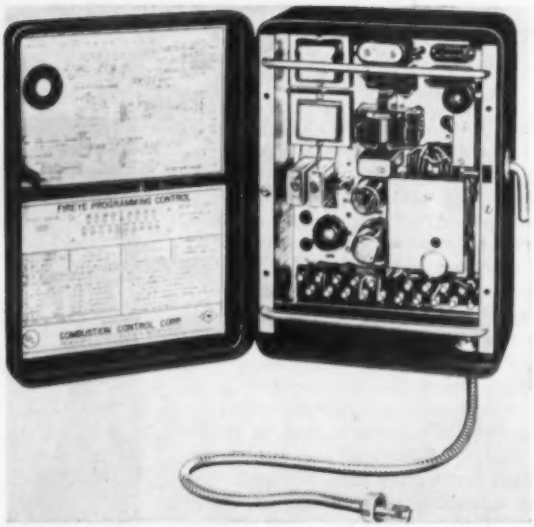


Diagram illustrates Fireye programming time intervals and sequence for packaged boiler controls with spark ignition.





Combustion Control's new scanner provides electronic supervision of all types of flames in a single unit.

Fireye flame failure safeguard and sequence control unit is at right center in this Cleaver-Brooks panel.

and efficiency with a minimum of attention and maintenance, the new packaged systems include provisions for such instruments as may be required for the guidance of the operator, checking the operation of the equipment, and accounting for the steam generated. These include: draft gages; combustion guides, such as steam flow — air flow meters, CO_2 recorders, and steam pressure — flue gas temperature recorders; and various other instruments to indicate or record the performance achieved.

The desire of engineers to know what their system is producing also is evident in the hot water field. New recorders are available that measure the temperature of the water entering and leaving the boiler as well as the flow rate. The arrangement provides a continuous measure of the load on the boiler on a Btu basis, from which efficiency can be readily calculated.

Water Conditioning

One very important consideration in the operation of any packaged type boiler is the quality of the water continuously introduced into the system, and boiler manufacturers incorporate provisions in their designs for ready inclusion of water treatment. Facilities include the normal arrangement of feed and blowdown lines as well as internal distributing pipes for feeding chemicals and connections for continuous blowdown lines. Many units have baffle arrangements near the blowdown connections to assure maximum sludge removal. Usually, the chemical feed, feedwater, and blowdown connections are arranged to adequately avoid short-circuiting among the various services.

It is perhaps unfortunate that the boiler manufacturers, while strongly recommending water treatment and clearly specifying minimum limitations on water quality, cannot insist on the installation of treatment facilities. Such procedure would be impractical because each project has its own individual requirements. Thus, this detail must be left to the water treatment consultant, who exhibits a keen awareness of the problem. Technical service contracts recently have been made available to the small plant and should be given careful consideration. Furthermore, scaled-down models of various conditioning system components have been developed as packages for use with small boilers. These can be utilized where external treatment is warranted.

Included in the packaged units available are: various types of clarifiers, some with automatic chemical feed arrangements; deaerating heaters in a wide range of sizes and with several increments of storage capacity; and packaged type softeners. Where only internal treatment is employed, the system can be arranged for continuous, proportioned feed of chemical, normally controlled from the raw water flow rate. Packaged blowdown systems also are available for recovering the heat from the blowdown water, with the flow rate being automatically controlled in direct proportion to the makeup water flow by use of a thermostatic valve.

One common method of feeding treatment and blowing off a small, regulated amount of the boiler salines simultaneously with the introduction of feedwater into the boiler is accomplished as follows. The feedwater pump is electrically connected to the chemical pump and a solenoid valve in the blowoff line. The blowoff line also contains a heat exchanger and an adjustable flow control valve preceding the solenoid valve. When the feedwater pump starts, the chemical pump simultaneously begins to pump compound into the boiler and the solenoid valve on the blowoff line opens. This permits a regulated amount of the boiler salines to be blown off through the heat exchanger, blowoff control valve, and solenoid valve.

In selecting water treatment equipment it is well to remember that the system must be large enough to handle the maximum feedwater flow. With packaged boilers that do not have a modulating type of feedwater regulator but operate intermittently from a high and

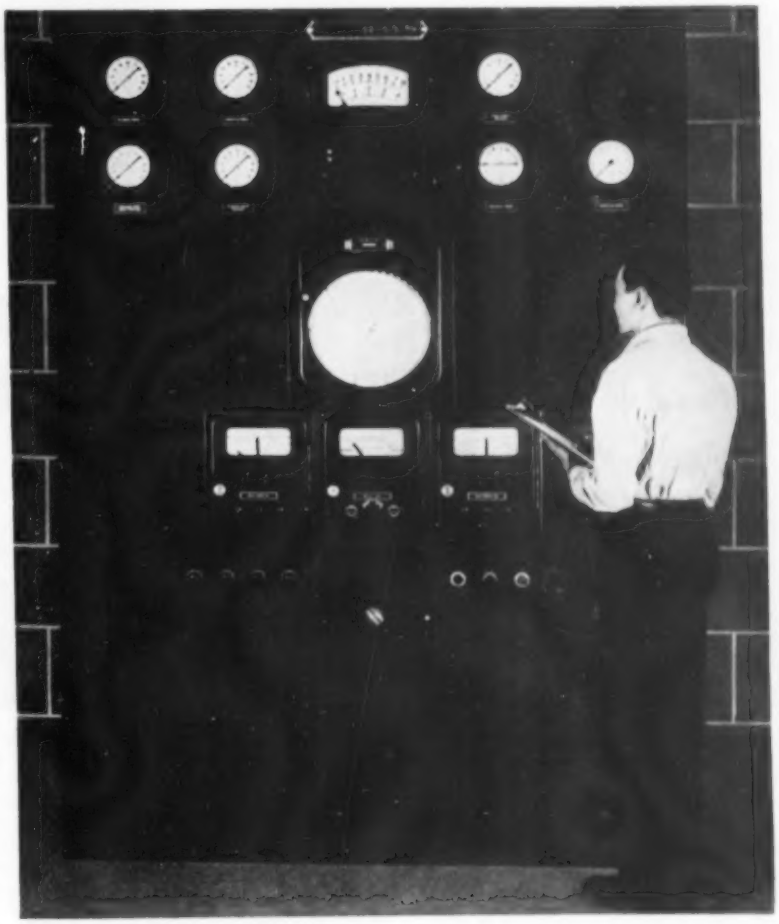
low level control, this maximum flow rate has very frequently been underestimated. During operating intervals the feedwater with high and low level control may be pumped at a rate up to 2½ times as great as it would be if pumped at an even continuous rate.

Internal Treatment

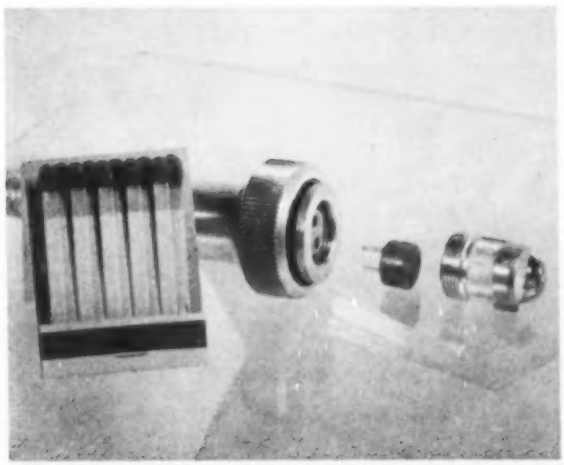
Internal treatment of the boiler feed may be practiced either by itself, or as an adjunct treatment with an externally softened water. The water consultant can evaluate individual circumstances and determine the system arrangement, but certain observations based on operating experience are of interest. Some authorities feel an excess phosphate type of treatment must be employed in combination with an alkali, a sludge-conditioning organic material containing an antifoam, a sulfite product, and a corrosion control material.

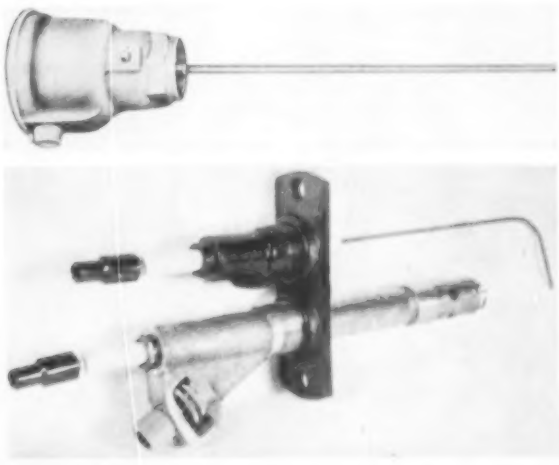
Application of these materials should be carefully controlled to prevent overtreatment or undertreatment with any of the individual components. On smaller jobs, briquetted chemicals may be introduced in slugs every few hours through a bypass pressure feeder. The much preferred method, however, is direct and continuous feed using a proportioning pump.

The selected treatment must precipitate hardness salts in the desired form to prevent scale formation in the radiant sections without

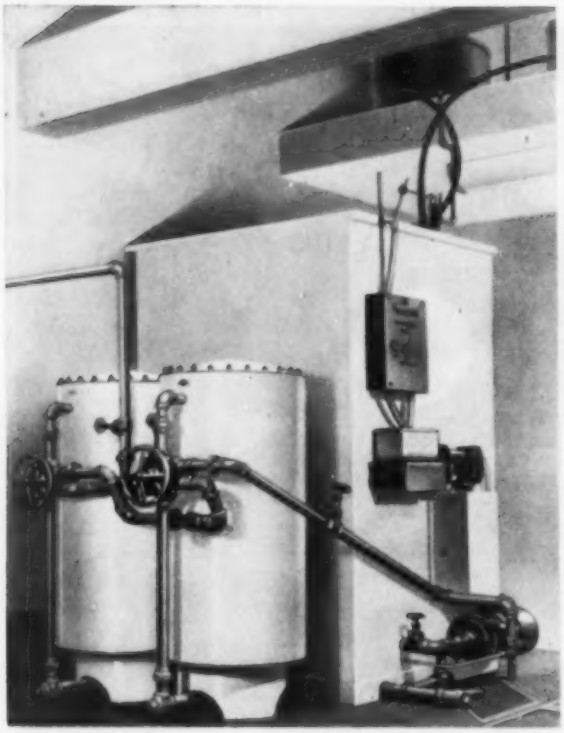


Hays produces packaged control systems of the fully automatic metering type.

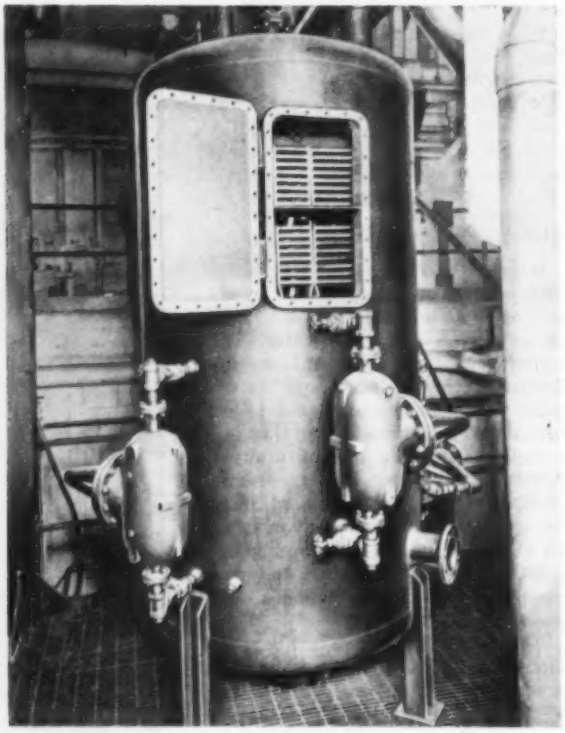




Combustion safeguards offered by the Wheelco Instruments Division of Barber-Colman Co. include: photo cell sensing unit for luminous and nonluminous flames, shown at left; conventional flame rod and head for conductivity and rectifier type systems, shown at upper right; and a pilot burner and electrode assembly for rectifier type systems, shown at lower right.



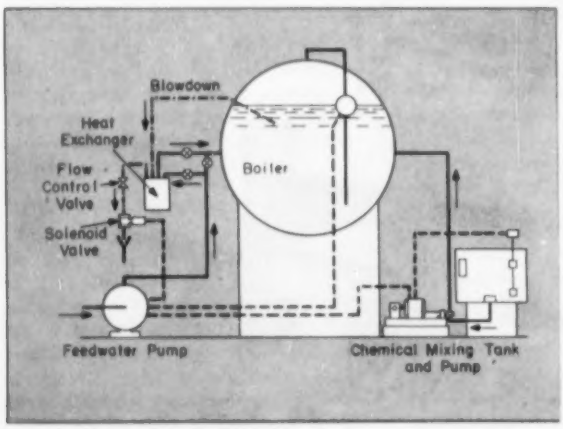
Permutit packaged precipitators for clarification and cold lime softening come in sizes from 500 to 3300 gph.



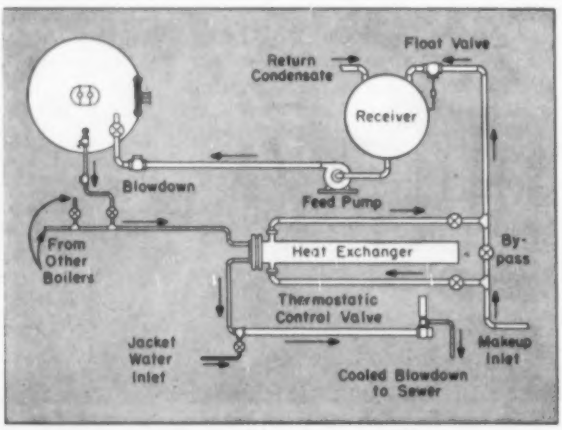
Capacity of this Graver packaged vertical spray-tray type deaerating feedwater heater is 38,000 lb per hr.

creating an excessive sludge condition in the cooler parts of the unit. To achieve the desired reactions, adequate hydrate alkalinity, a controlled excess of phospate, and a sufficient amount of silica should be present — but too much of any of these can create problems. For example, a deficiency of silica or excessively high phosphate content can drive the reaction to the point where magnesium phosphate sludge, which is very sticky, can form. Conversely, if silica is excessively high and insufficient phosphate is employed, a very hard glassy-like scale can develop on the tubes.

Intelligent control will require frequent tests to maintain specified tolerances. This in itself requires an effort and may be part of the rea-

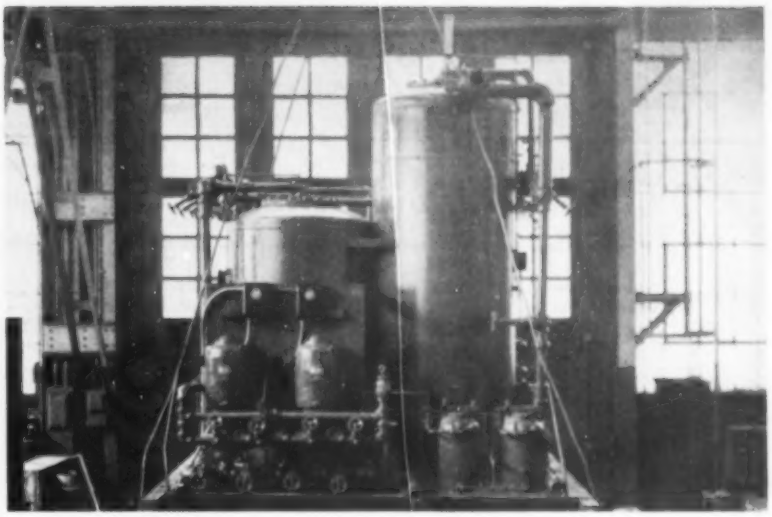


Diagram, by Permutit, shows simultaneous feedwater flow control of chemical feed and continuous blowdown.



Henszey's automatic continuous blowdown system utilizes thermostatic control; includes heat recovery equipment.

Worthington packaged zeolite softener complete with booster pumps, coagulant feeders, and filter is shown at right.



son that certain installations have neglected the very important factor of feedwater treatment. Furthermore, periodic inspections should be made even though the treatment method drastically limits the suspended solids content. This is necessary because sludge can become a problem, especially where the make-up water is not softened.

Chloride or dissolved solids tests generally are employed to control blowdown. A representative sample is obtained, usually from the continuous blowdown line through a cooling coil, and tested periodically. The results will indicate the number of cycles of concentration that can be tolerated for a specific condition although the ultimate limits may be governed by any number of circumstances including: total hardness, total solids, total alkalinity, or even silica. Both boiler design and the quality of the raw water will require consideration.

Corrosion Control

When sulfite or a sulfite containing compound is used with an undeaerated, externally softened water, it is preferably fed to the feedwater line in sufficient amounts to assure the continuous presence of an excess of sulfite. An included table indicates theoretical dosages of sodium sulfite for waters saturated with air at various temperatures and atmospheric pressure. Besides this amount, sufficient sulfite product should be employed to maintain an excess of 30 to 60 ppm in the boiler water.

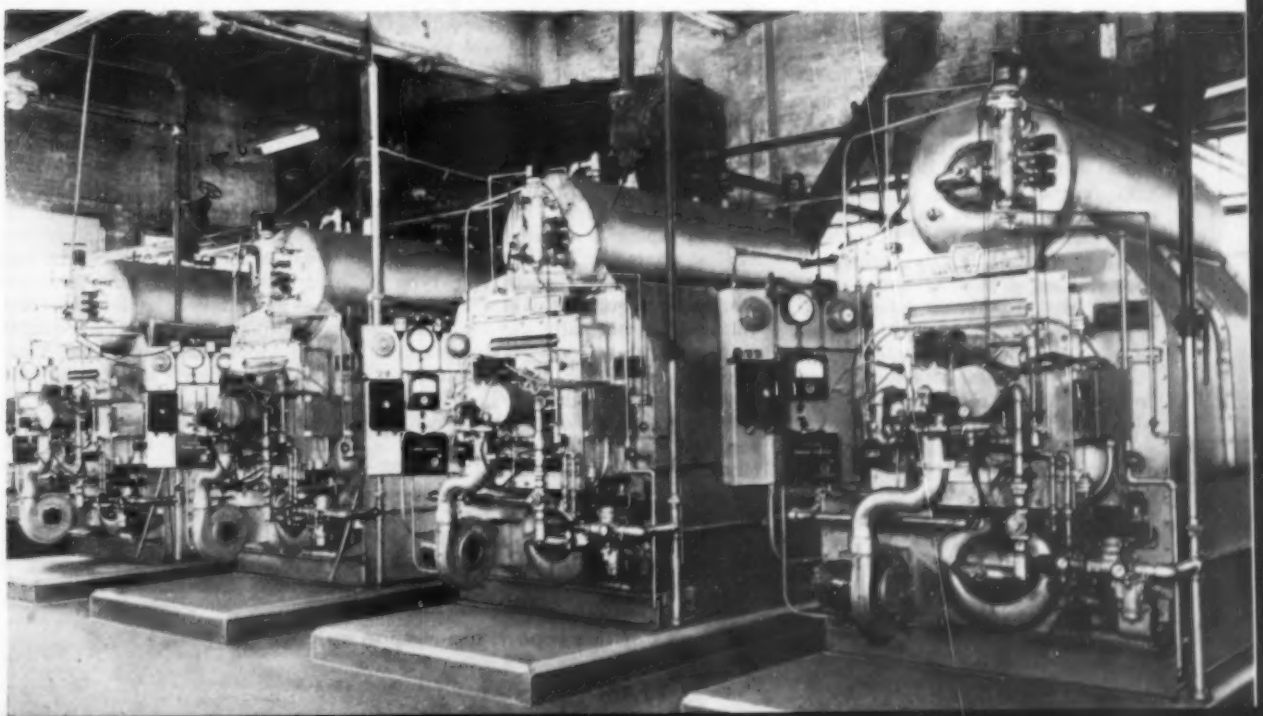
It should be noted that the reaction between sodium sulfite and dissolved oxygen is rather slow in cold water but is very rapid in hot water. Where the size of the boiler will warrant it, an open heater or deaerator is preferable because it removes the dissolved oxygen before the water reaches the boiler. Deaerators also provide lower operating costs than those experienced when feeding sulfite, and they do not increase the total solids, which, in turn, helps to limit blowdown.

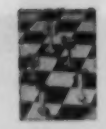
Amines

Where a neutralizing amine is employed for control of steam and return line corrosion, the pH of the condensate should be maintained at approximately 7.5. Filming amines do not neutralize carbon dioxide but function by forming a nonwettable film on metal surfaces, thus providing a barrier between the metal and the corrosive condensate. Corrosion control by filming amines usually is evaluated by means of exposure of test specimens in the system.

When presenting a problem to a

Erie City's Keystone boilers include internal chemical feed and continuous blowdown piping. Four 75 hp units are shown.





The Packaged Boiler Picture

THEORETICAL SODIUM SULFITE DOSAGES FOR WATERS SATURATED WITH AIR

At various temperatures and at atmospheric pressure

Temperature degrees F	Dissolved oxygen parts per million	Sodium sulfite lb per 1000 gallons
32	14.6	0.96
50	11.3	0.74
68	9.1	0.60
86	7.5	0.49
104	6.4	0.42
122	5.5	0.36
140	4.7	0.31
176	2.8	0.19
212	0.0	0.00

water treatment consultant, careful study of the internal arrangement of the boiler is necessary. Several cases of short-circuiting between continuous blowdown and chemical feed lines have emphasized the necessity of properly sized and located connections. Feedwater and treatment must be properly mixed before circulating the water through the unit.

Above all, with a raw water which varies in composition, it is necessary to have equipment that is flexible enough to handle all possible conditions. The packaged boiler is an excellent piece of industrial equipment and deserves water treatment equipment of the correct type and size to take care of all contingencies. Greater capital investment will be required, and operating costs will be somewhat higher, but good water treatment more than pays for itself.

Components

Since their inception, packaged units have been equipped with a very fine complement of auxiliary equipment. The vast majority of the units employ pressurized firing, and the forced draft fan is recognized as an integral part of the design. Units arranged for induced draft operation also have mechanical draft fans included with the boiler.

Lately, many manufacturers are finding that the ultimate purchaser is requesting an even more extensive array of equipment with his packaged unit. Some companies report that their customers ask for integral feedwater pump and receiver assemblies, continuous blowdown facilities including flash tanks and heat exchangers, feedwater treatment systems, fuel tanks and supply systems, wall disconnect switches and various other features. The tendency is to further reduce the need for the separate purchase of auxiliary equipment. This can be something of a headache to boiler manufacturers, since it means taking on responsibility that cannot be properly considered a part of the boiler installation.

Boiler manufacturers, of course, do not have any objections to supplying, installing, and accepting responsibility for normal boiler trim. Such material has always been considered a part of the package. If anything, there is an increase in the use of high quality components with all types of steam generating equipment. These include safety valves, boiler feed line stop and check valves, blowoff valves (often in multiples), steam pressure gages, water columns (often with high and low level alarms), and drum valves for venting, chemical feeding, continuous blowdown, and draining water columns and gages. All interconnecting piping is included.

Most water tube designs utilize single element, modulating type feedwater regulators while the fire tube boilers normally include water columns with low water cutoff and built in feedwater pump switches operated from high and low level. All regulators are of industrial construction, specially designed and sized for the packaged unit.

Soot blowers and soot blower piping are considered a standard part of all water tube assemblies. Some designs have added elements to assure even greater control over gas side cleanliness. All designs offer maximum accessibility for manual cleaning, and with many units, should difficulties arise, tubes can be replaced without disturbing other tubes in the generating bank.

As might be expected with automatic operation, most units include a maximum number of safety controls. In addition to the flame failure and programming controls, the normal packaged unit guards against such unsafe conditions and failures as: low water level, low oil pressure, low combustion air flow, high steam pressure, (or water temperature on hot water boilers), and virtually any other conditions that could occur. Some projects, which demand extreme reliability, even go to the extent of installing compact standby generating facilities to cover the contingency of a power failure. Duplication of essential auxiliaries often can be economically justified.

Installation and Service

All manufacturers furnish very complete instruction manuals with their equipment. Many of them also have established service organizations throughout the country, staffed by factory-trained personnel. These men start up all new installations and give on-the-job instructions on operation, maintenance, and trouble shooting. If the fuel is changed at a later date, the service man returns to the job and provides any necessary additional information.

Some service organizations also offer contracts to cover periodic inspections and emergency repairs. At other plants preventive maintenance programs are adopted. Both procedures warrant careful consideration as reports show they help to sustain performance and to minimize downtime and repair costs.

The tools of the trade are at industry's command. Today, steam and hot water requirements can be satisfied more efficiently than ever before—and at very reasonable cost. The equipment has excellent quality and provides reliable service. Thus, the major burden is now on the purchaser, who can best guard his interests by: 1. careful initial equipment selection, 2. intelligent care and supervision commensurate with the design of the product, 3. providing service facilities to meet the recommendations of the manufacturers, and 4. rigidly following a preventive maintenance program.

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In addition to being a faster method of repairing damaged threads, inserts provide Santa Fe's diesel shop with a means of salvaging cylinder heads which might otherwise be scrapped.

Maintenance Applications for Wire Thread Inserts

HOWARD O. HAAS
Director, Field Engineering
Heli-Coil Corporation

REPAIRING and salvaging equipment made inoperative by stripped threads is a frequent problem of the plant engineer. Often, important equipment is kept out of service for excessive periods of time while threads are repaired by lengthy methods and, in extreme instances, an expensive cylinder block or fuel pump is scrapped because the threads in one hole are damaged beyond repair. Because of the increased use of such light metals as aluminum and magnesium, stripped threads are becoming a more frequent problem since threads in these metals are easier to damage than those in steel.

Many plants are now using wire screw thread inserts as a means of reducing the time required to effect repairs. These simple but effective devices are being used to permanently repair damaged threads in such materials as steel, cast iron, aluminum, brass, copper, magnesium, plastics, and wood.

Wire thread inserts are precision-formed coils made of 18-8 stainless steel wire with a diamond-shaped cross-section designed to accommodate internal and external threads simultaneously. When inserted into tapped receiving holes, they form nominal-size internal threads that are stronger and more desirable than unprotected threads of the same base material. For specialized applications such as when used for electrical contacts, inserts made of phosphor bronze also are available.

When assembled in a specially tapped hole, the insert presents a permanent internal thread that conforms to National Bureau of Standards Handbook No. H28, "Screw Thread Standards for Federal Services," published in 1944, and its 1950 supplement.

Because they are flexible, wire screw thread inserts automatically adapt themselves to the female receiving threads of the part and the male threads of the fastener. This flexibility compensates for angle and lead error between mating threads, and distributes the load equally over all of the threads. Also, because of the work-hardening produced during manufacturing, stainless steel inserts are tougher than standard capscrew and stud materials. The inserts therefore give a minimum of 25 percent greater loading strength than unprotected tapped threads in the same material.

Recent tests conducted on 24ST4 aluminum resulted in bolt breakage

TABLE 1 — LENGTHS OF ENGAGEMENT FOR THROUGH HOLES

Workpiece Material	Ult. Tensile Strength (psi)	Engagement length in diameters for commercial screws and studs
Wrought Aluminum	17,000	1½ — 2
	30,000	1 — 1½
	60,000	1
Cast Aluminum	20,000	1½ — 2
	32,000	1 — 1½
Cast Magnesium	34,000	1 — 1½
Forged Magnesium	50,000	1
Cast Iron	——	1
Steel, Steel Forgings, Steel Castings	50,000 & up	1

With inserts, Danbury Bus Corp. repairs broken wheel studs without removing the wheel from the bus. Before, the bus was made inoperative for a full day.

at 275 in-lb in the insert-protected hole, while a bolt in an unprotected hole in the same material broke at 175 in-lb after the unprotected tapped threads had begun to strip. Standard AN-approved ¼-28 bolts with the same amount of engagement were used for each test.

Diesel Engine Repairs

A typical damaged-thread problem being solved with inserts is the salvage of tractor-engine cylinder heads in the repair shops of Caterpillar Tractor Co. This company has prepared an illustrated procedure sheet outlining the wire-insert method of thread repair. Inserts are used in these shops to repair threads that are damaged when screw-in type precombustion chambers seize as they are removed from the cylinder-head castings.

In another example, inserts are speeding the repair of worn and stripped threads in the Santa Fe Railway System's heavy diesel repair shops. This reclamation process is saving expensive parts from the scrap pile and is returning them to service. The heavy repair shop, located at San Bernardino, Cal., which repairs more than 750 diesel-electric locomotive units, uses more than 500 stainless steel Heli-Coil wire thread inserts per year. There is no record of a thread repaired with these inserts having stripped, pulled out, or shown any appreciable deterioration.

Typical repairs by this method include the replacement of damaged threads in cylinder heads, governor castings, cylinder liners, water pumps, engine blower housings, traction motor bases, and air brake parts. In addition to providing a faster, superior thread repair method, these inserts are more than paying their way in equipment saved from the scrap heap. For instance, cylinder heads costing $56.00 to $76.00 each, and governor parts costing $77.00 to $100.00 each, which might otherwise have to be scrapped, are quickly and economically repaired by the use of inserts.

Another transportation company, the Danbury Bus Corp., used inserts to solve an expensive repair problem resulting from broken studs in the wheel hubs of its passenger coaches. Before the use of inserts was initiated, if the broken studs could not be worked out without damaging the threads, it was necessary either to re-drill new holes, or in some instances to braze or weld the holes and retap—an operation requiring that the bus be taken out of service for a full day. If the hubs were designed with thin-walled bosses which did not permit drilling a new hole circle, or repair by brazing or welding, the only solution was replacement at a cost of $40 to $50 per hub.

Now the tapped holes are repaired with inserts while the hubs are still on the coach, and the time required is only 20 to 30 minutes.

Construction Equipment

Construction equipment repair shops are finding that damaged or stripped threads in the engines, bodies, and working parts of tractors, graders, cranes, trucks, shovels, ditchers, rollers, compressors, and mixers can now be quickly and permanently repaired with stainless-steel inserts.

The Colonial Sand and Stone Company, Inc., not only uses inserts to repair damaged threads during the periodic overhaul of equipment in the repair shops, but also for on-location repair of damaged field equipment. Periodically, each of the company's 400 heavy-duty road vehicles is disassembled for inspection and reconditioning. The threads in tapped holes are inspected for wear and are replaced with an insert if they are worn beyond the manufacturer's minimum specifications.

A frequent source of thread failure is in eight tapped holes which receive capscrews for holding clutch housings to diesel engines. Inserts, used to repair these threads, permit the capscrews to be retightened with enough torque to prevent further movement. Thread failure also occurs in the aluminum valve housings of air brake systems. Threads tapped in the aluminum often strip during disassembly or reassembly for overhaul and repair. All damaged

Periodically, each of Colonial Sand's heavy duty road vehicles is disassembled for reconditioning. Wire thread inserts are used to replace any worn threads.

Inserts used for thread repair in heavy motor castings require less repair time and provide greater strength.

Inserts used in wearing plates of steel rolling mills triple running time by providing high wear resistance.

or stripped threads are replaced with 5/16-18 inserts.

Worn threads in the power flange of the diesel engine crankshaft also are repaired with wire thread inserts. Threads in tapped holes of the flange receive sixteen 1/2-20 capscrews to join the crankshaft to the clutch assembly. Repeated motor torque wears these threads at an accelerated rate until failure causes breakdown. After engine overhaul, these threads are inspected carefully during reassembly and are repaired if found unsatisfactory.

In the field, wire inserts prove extremely valuable when housings of power take-offs become loose because of overloads or vibration, and the capscrews will not remain tight because of worn threads in the casting. This permits dangerous movement between housing parts and, if not corrected, will cause breakdown. By removing its hold-down bolts, a bell housing can usually be shifted to one side to expose the screw holes under it. Worn threads in an exposed screw hole are drilled out on the spot, the new hole is retapped, and the insert is installed. The equipment is usually back in service in two to three hours. Inserts also are used for repairs in the field when cover plates start to leak because of vibration-worn threads.

In contrast with the use of wire thread inserts, the previous methods of thread repair used by the company always involved removal of the damaged part from the vehicle. Many castings could not be repaired by retapping for oversized bolts because casting walls were too thin. Holes filled with weld metal were difficult to machine, and threads produced were too brittle for satisfactory service. In many instances, costly and otherwise serviceable castings had to be discarded because of worn or stripped threads.

Because of its success with wire thread inserts, Colonial Sand & Stone has assembled maintenance kits containing a complete selection of the inserts, together with the necessary taps and inserting tools, so as to be ready whenever a worn or stripped thread is discovered.

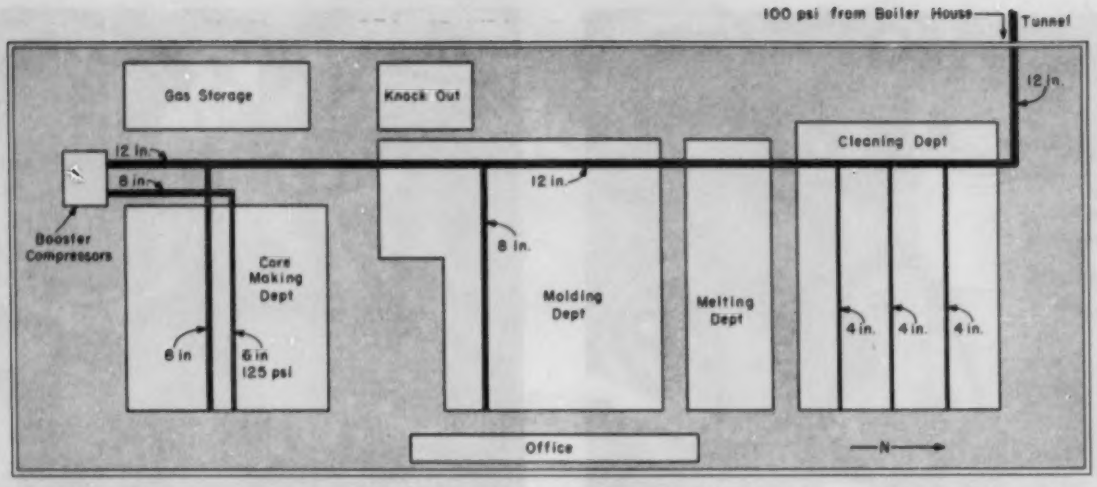
Steel Mill Machinery

At the Niles Rolling Mill Division of Sharon Steel Corp., inserts are used to eliminate damage caused by loose wearing plates rubbing against mill housings. Previously, the corrosive action of coolant water, combined with constant pressures required to operate the mills, caused threads to wear and strip. As a result, the wearing plates chafed against the mill housings, causing excessive damage. To protect the costly housing faces from this damage, it was necessary to overhaul the mills twice a year. Now, with the wire thread inserts, major overhaul need be scheduled only once every 18 months.

These mills reduce steel plates from approximatedy 1 in. to sheets as thin as .128 in. Each mill incorporates four, 17 in. wide by 65 in. long by 2¼ in. thick wearing plates. Each plate is secured to the housing by 22 bolts. Before the wire thread inserts were used, the stripped threads, originally ¾ inches in size, were enlarged ⅛ inch and retapped until they reached 1-inch and required another retapping. They were then filled with weld, drilled to the original size, and tapped. This sequence of operations continued throughout the life of the mill. As much as 80 man-hours were often required to complete a repair job. By using inserts, the job can now be accomplished in 24 man-hours.

Cost Savings

At a large eastern repair shop, wire thread inserts are speeding thread-repair operations on heavy electric motor castings. In comparison with three other thread-repair operations previously tried—the oversize-thread method, the build-up by weld method, and the solid-bushing method—inserts have proved to be the most efficient in conservation of time, labor, and materials, and the most effective in producing a permanently repaired thread. The threads formed by the insert can withstand 20 to 30 percent higher loads than the original threads, and can be installed in 80 percent less time than conventional repair methods require. Cost savings are as high as 60 percent.



Compressed air at 100 psi is brought into the foundry by a 12-inch main and is distributed to every department in the plant. A booster station increases pressure to 125 psi for use in the coremaking department.

Compressed Air

For Ford's Cleveland Foundry

Ford engineers have designed an outstanding distribution system to supply compressed air to the many sites throughout this huge foundry. Careful planning has resulted in an unusually low pressure drop in the lines.

A CONTINUOUS SUPPLY of compressed air at constant pressure is essential to the efficient operation of the Cleveland Foundry of Ford Motor Company. Although true of most production foundries, it is especially pertinent at the Ford plant where the combined efforts of the engineering and production departments of Ford and the many manufacturers of foundry equipment have culminated in one of the most highly mechanized, almost automatic foundries in the country.

The main foundry building is 1390 feet long, 540 feet wide, and has a total of 1,022,000 square feet of floor area. Compressed air is used in every department. Basically, the plant is divided into departments according to functions, consisting of melting, molding, coremaking, cleaning, maintenance, and storage.

The coremaking department is a large user of compressed air. This division, extending 360 feet and covering an area of approximately 192,000 square feet, consists of 11 production lines with 84 coremaking machines, nine of which are large, five-station automatic units. The five-station coreblowers are rated at 300 blows per hour, requiring 32.26 cubic feet of air per blow, while the other coreblowers on the lines work 150 blows per hour using 22.6 cubic feet of air per blow. Blow pressure from the powerhouse is 100 psi. For jobs requiring higher pressure, a booster station increases air pressure to 125 psi. Air needs for the coreblowers alone total well over 400,000 cubic feet per hour.

In addition to the use of compressed air in the coremaking machines, large quantities of 60 to 80 psi air are consumed by a push button controlled pneumatic system used to deliver prepared core sand to the individual coreblowing units. Other uses for compressed air in this department bring the total needs of the coremaking section to approximately 500,000 cubic feet per hour.

Molding Department

Another large consumer of compressed air is the molding department. This division, occupying a floor area of about 350,000 square feet, uses a total of 66 molding machines on eight molding conveyor loops. On the average, 100 molds are turned out by each machine per hour. Approximately 50 cubic feet of air are used per mold, making an average of more than 330,000 cfh of air being used by these machines.

Considerable amounts of air also are used in the sand preparation and handling equipment. Each molding line is serviced by three automatic sand mullers of 2000-pound capacity. Air is used as the propelling force to deliver seacoal from the coal crush-

ers to the hoppers, and for numerous air cylinders used for transferring, moving, and control purposes. Total consumption of compressed air in the molding department is estimated at over 500,000 cubic feet per hour.

Cleaning Department

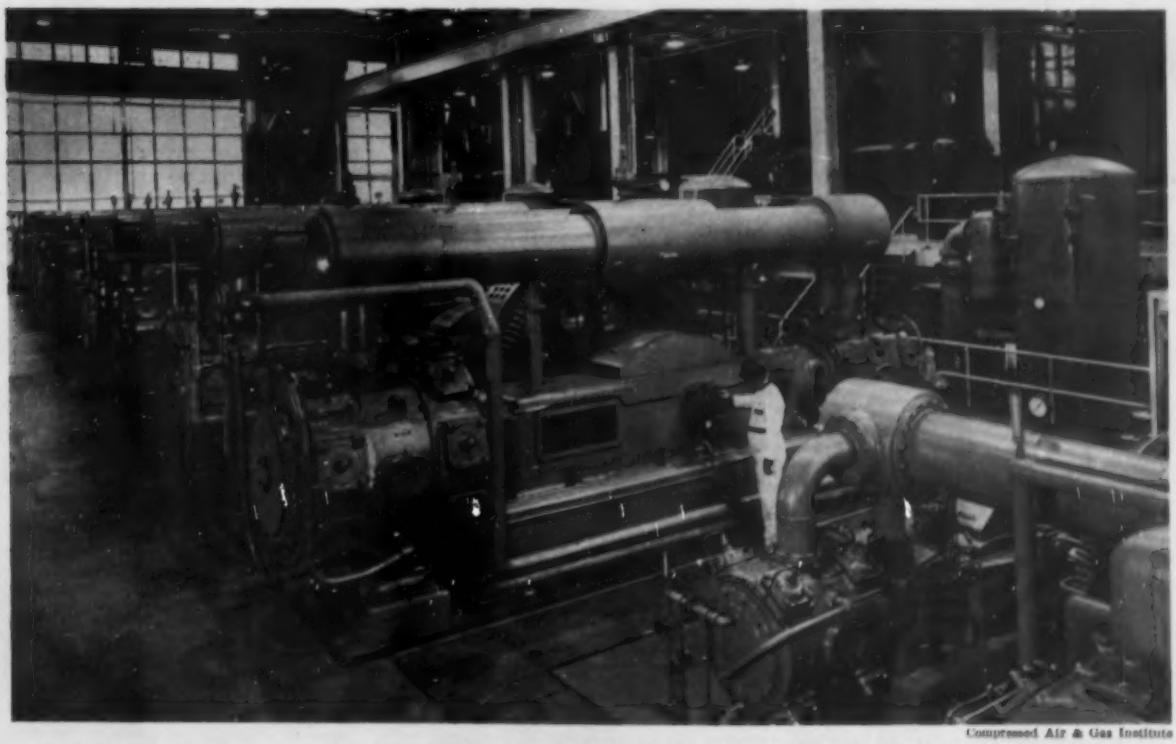
The cleaning department, another important user of compressed air, has been designed for flexibility. This department occupies a 360 by 860 foot area. All equipment is arranged so that the rough castings enter at the west side, travel the length of the department while undergoing various operations, and emerge cleaned and inspected at the east side. These castings are divided into three general classifications—cylinder blocks, cylinder heads, and other parts such as manifolds, flywheels, bearing caps, and oil pumps. Handling and cleaning processes vary for each classification.

Considerable quantities of compressed air are used in this department for operating such equipment as air hoists, scaling hammers, grinders, chippers, and continuous-type, shot blasting machines. Altogether, there are about 200 air hoists in use at the Ford foundry, with the larger portion being used in the cleaning department. A 1000-lb capacity air hoist consumes about 20 cubic feet of compressed air to lift 1000 pounds a distance of 10 feet. Since these hoists are in almost constant use, they consume about 200,000 cubic feet of compressed air per hour.

Compressed Air & Gas Institute

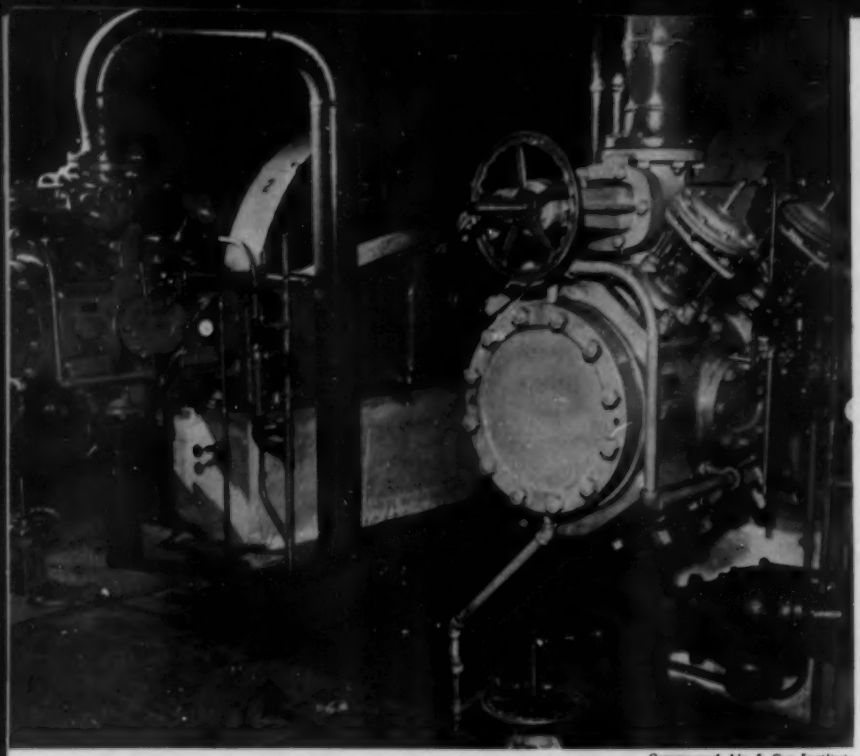
Compressed air from the aftercooler passes through a knockout separator, which condenses most of the remaining moisture before it goes to the vertical receiver.

To supply air to the many sites spread out in this huge plant, Ford engineers have designed an outstanding distribution system consisting of more than three miles of compressed air lines plus hundreds of feet of flexible hose for bringing the air power into the machines and tools. By careful planning, these engineers have been able to hold the pressure drop in the air lines to an



Compressed Air & Gas Institute

Six horizontal, duplex, water-cooled compressors with a total rating of 48,928 cfm supply compressed air to the foundry.



Compressed Air & Gas Institute

Two booster compressors, located in the coremaking department, increase the pressure of the air from 100 psi to 125 psi for use in the coreblowing machines.

unusually low amount—estimated to be only 3 psi per 1000 feet of line.

Compressors

Installed in the boiler house are six two-stage compressors, supplying a total of 48,928 cubic feet of air per minute at 100 psi. Five of these units, which are of horizontal, duplex, water-cooled design, produce 9414 cfm each, while the sixth has a capacity of 1858 cfm. Of the total compressor displacement, approximately 8000 cfm is considered standby. This allows any one compressor to be shut down for maintenance without interrupting service to either the foundry or the engine plant.

Although Ford produces steam for both the foundry and engine plant, the engineers found it cheaper to use electric power for driving all compressor units. The five large compressors are driven by 1750-hp electric motors, while the smaller unit uses a 300-hp motor. Estimated cost of the compressed air is 3½ to 4 cents per 1000 cubic feet.

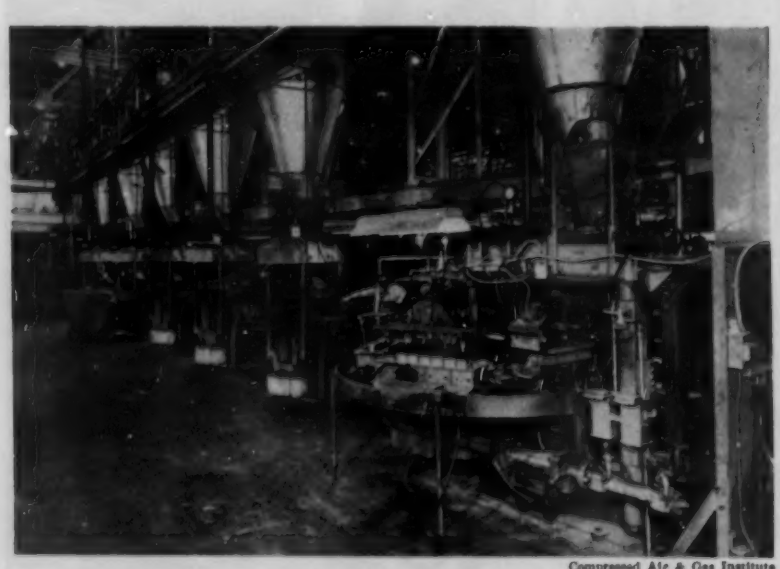
From the compressors, the air passes through vertical aftercoolers which condense a large percentage of the water vapor. The condensate is trapped in a knockout separator. Each compressor has an air receiver, 66 inches in diameter by 18 feet long, with a volume of 428 cubic feet. These receivers insure a steady flow of air to the service main and furnish reserve capacity to take care of sudden momentary demands.

Compressed Air Main

Air from the compressors is piped to the foundry from the boiler house, approximately 100 feet to the west, in a 12-in. underground steel line. This main enters the foundry in the cleaning department and runs the entire length of the plant. Inside the plant the line is no longer underground but is hung from the roof for a distance of 1000 feet. The total length of the 12-in. line is approximately 1300 feet.

Because of its length considerable heat loss takes place in the line, thus reducing the moisture-carrying capacity of the air and causing precipitation to occur. To remove the condensate, Ford engineers take advantage of various levels of the main as it travels along the ceiling to the different departments. The condensed moisture is trappd by gravity and is eliminated by means of traps. These simple gravity traps prove very effective.

In addition to water, this system eliminates the oil vapor carried over from the compressor cylinders. Like water vapor, the oil vapor condenses when cooled. Unless removed, condensed oil will collect in the pipe lines to form deposits which can be dangerous. Eliminating water and oil avoids considerable annoyance and expense, and keeps the capacity of the lines high. In addition to moisture traps, drip legs have been placed at the end of each line of machines in the core and molding rooms.



Compressed Air & Gas Institute

The five-station coremaker on the right, rated at 300 blows per hour, consumes over 9600 cf of air per hour, while the other blowers use about 3300 cfh each.

Booster Station

The core room booster station, which provides 125 psi air for this department, consists of two, horizontal, single-stage units with standard multi-V drives, each having a capacity of 2000 cfm. From these compressors, the 125 psi air is piped into two 60-in. by 16-ft receivers, each

with a volume of 325 cubic feet.

A six-inch line, running approximately 400 feet, is used to carry the air from the booster station through the core room for use on the 11 production lines. Each coremaker line is serviced by a 14-in. main, 120 feet long, from which three-inch lines feed into each machine. The 14-in. line, which serves as an air receiver, stores the air and dampens discharge pulsations.

Distribution System

Air at 100 psi also is used in the core room. An eight-inch line, running parallel to the 125 psi line, carries this air across the width of the foundry, and 2½-in. lines bring it into the coremaking machines. The lower pressure is used by the coremakers, relievers, draw machines, and pneumatic sand delivery system.

The pneumatic delivery system, which consists of three conical-shaped pressure tanks, delivers the prepared sand from the mullers to the coremaking machines and to central storage bins. In operation, one-ton batches of sand fall directly into a pressure tank from a muller, and a door at the top of the tank closes to form a tight seal. Compressed air at 60 to 80 psi (pressure varies with the type of sand and blowing distance) enters the tank through six ¾-in. pipes attached tangentially at equally spaced intervals around the side walls, and through one two-inch pipe at the top of the tank. Purpose of the air is to make the sand fluid and to carry it through a four-inch pipe at the bottom of the tank.

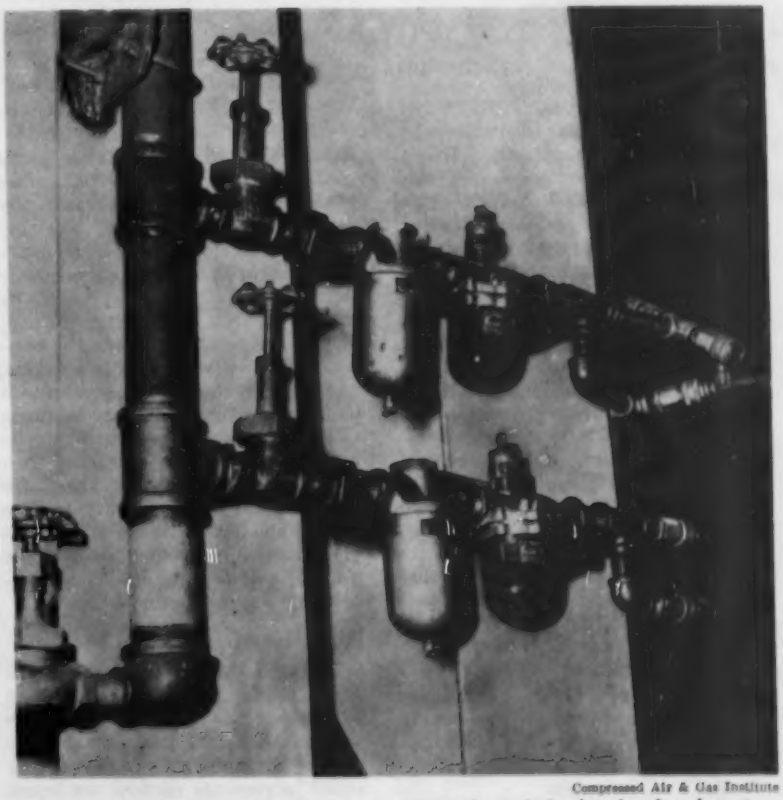
Compressed air for the eight lines in the molding department is supplied by an eight-inch line tapped from the 12-in., 100 psi main. This line runs the length of the molding department—approximately 350 feet. A three-inch pipe brings the air into each production line where it is filtered and lubricated prior to use on the molding machines.

Three four-inch lines, tapped off the 12-in. compressed air main, have been installed to bring 100 psi air into the cleaning department. To provide maximum service life for all pneumatic tools in this department, filters and lubricators have been installed on all air lines leading to flexible hoses.

Because of the many benefits offered by compressed air, Ford engineers have used this power source extensively throughout the Cleveland Foundry. The many applications in which it is being used are playing an important role in the efficient operation of this plant.

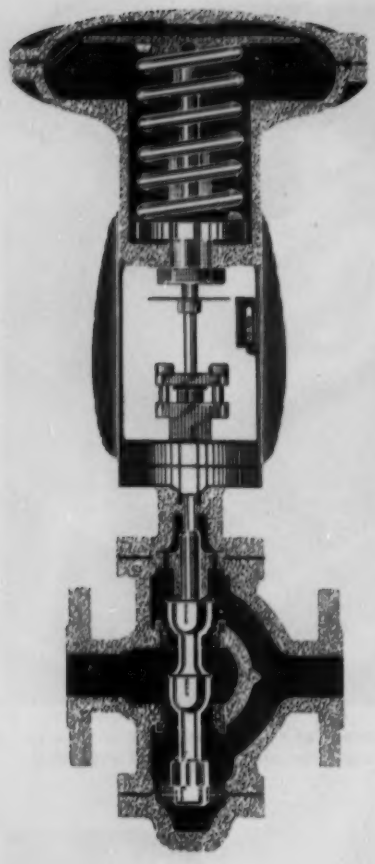
Compressed Air & Gas Institute

Gravity traps, installed so as to take advantage of the various levels of the compressed air main, remove water which passes the aftercoolers and separators.



Compressed Air & Gas Institute

To insure maximum service life for all pneumatic tools in the cleaning department, a filter and lubricator is used in each line leading to a flexible hose.



A typical automatic control valve and regulator generally used to maintain desired flow conditions in a centrifugal pump system.

Centrifugal Pump Controls

Any discussion of centrifugal pumps deserves at least brief mention of the general principles governing the application of throttling valves and regulators. Because efficiency of a centrifugal pump system often depends upon proper choice of the characteristics of the control, its location in the system, and methods of operation, these are given due emphasis.

IGOR J. KARASSIK and ROY CARTER
Worthington Corporation

BECAUSE THE MAJORITY of pump controls are based on throttling either the main delivery stream itself or some part of this stream in a take-off branch, it is important for the plant engineer to understand the application of throttling valves — manually, automatically, and semi-automatically controlled.

Controls should have the following characteristics: accuracy, sensitivity, speed, and power. These characteristics are imparted to the control apparatus by the manufacturer. Nevertheless, unless the controls are properly applied, they will not function satisfactorily.

Proper Measuring Point

Accuracy is obtained only if the variable to be controlled is measured under conditions making possible a true reading. Pressure or flow measurements can be distorted if the measurements are made at poor locations or if the measuring element, or the piping adjacent to it, is allowed to become dirty, clogged, or incrusted.

Controls must respond to the slightest deviations from the desired value of the variable being controlled. To obtain such sensitivity, it is necessary to carefully evaluate the application. For instance, if the controlling or measuring element is excessively oversize in relation to the quantity to be measured, all sensitivity is lost. Where the range of operating conditions varies within wide margins, and where sensitivity is required under all conditions, it may be practical to split the quantity to be measured into two portions. Two measuring elements are used to integrate the total quantity for the upper range of its value and a single element is used whenever the total is reduced to less than one-half of its maximum value.

Valve Design

To fulfill the requirements of accurate and sensitive regulation throughout the full operating range of the controlled equipment, valve design should give substantially equal increments of flow for equal increments of valve stem travel, regardless of whether the valve is near the closed or open position. The so-called "straight line characteristic valve" design is generally available.

The action of the control must be quick and positive. Automatic valves and regulators can be classified into two separate groups: direct acting and pilot operated.

Direct-Acting Regulators

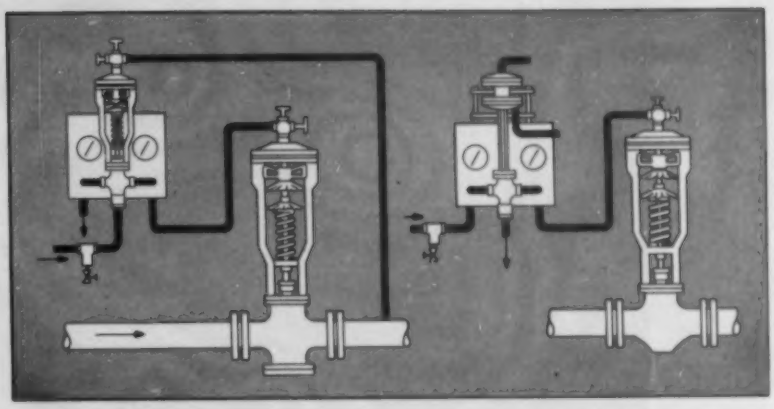
Direct-acting regulators are operated by the pressure of the system which it is designed to control. This pressure acts directly on one side of a diaphragm, bellows, or piston. The balancing force, which is set to a predetermined value, may be one or more springs, a weighted lever, or a preset air pressure. Direct-acting regulators are applicable where the variable to be controlled is the pressure in the system.

Direct-acting, spring-loaded. Single or multiple spring-loading may be used, depending on the range of the controlled pressure, on the maximum valve travel, and on the total pressure load acting on the

diaphragm, bellows, or piston. Spring-loading is most favored for the majority of regulators because of its inherent compactness. These regulators, however, cannot control pressures with extreme accuracy because of the variation in the compression of the loading springs between the full open and full closed positions of the valve. The application of the direct-acting, spring-loaded regulator must therefore be restricted to relatively low pressures and either narrow ranges of valve positioning or where there is no need for very accurate regulation of pressures.

Direct-acting, weight-loaded. This type of control is very sensitive to small pressure variations and avoids the shortcomings of spring loading because the dead weight lacks the compression variation inherent in springs. It is limited to low pressure service by the large weights required as pressures increase and by the cumbersome construction.

Direct-acting, air-loaded. The general characteristics of an airdome loaded control valve are the same as those of the weight-loaded regulators—it is possible to maintain in both a constant loading pressure. Its main advantage is the elimination of impractically large and cumbersome weights. This permits its application to installations requiring very wide pressure ranges. Unlike the weight-loaded regulators, the airdome control needs frequent checking of the loading pressure and may need more frequent adjustments.



An external pilot-operated regulator permits the main regulating valve to precisely follow minor pressure variations in the system being controlled.

Pilot-operated controls are preferred whenever the forces involved in adjusting valve positioning are excessive for the use of direct-acting controls.

Internal pilot operating regulators. Just as in the case of direct-acting controls, internal pilot operated regulators are only applicable to maintain pressure relations in a pumping system. The pilot is built into the main valve and is operated by the controlled pressure while the main valve is actuated by the initial pressure upstream of the control. These units are self-contained and compact, requiring no external operating pressure supply, and are therefore unaffected by any possible external supply failures of the auxiliary air or water.

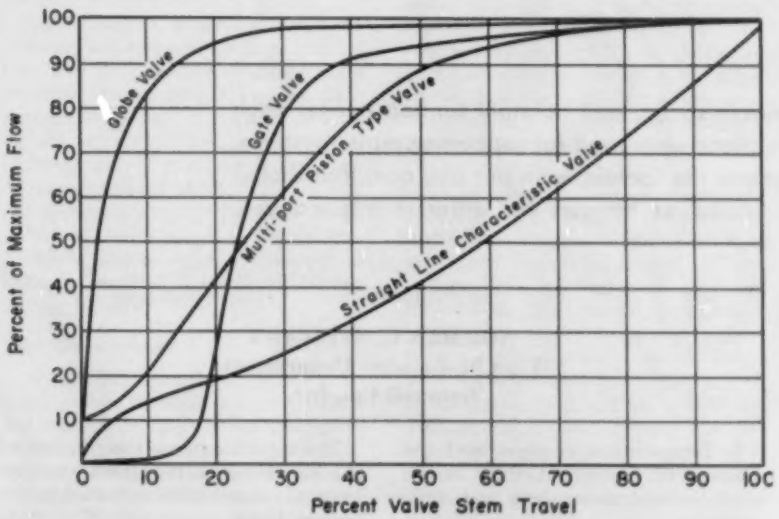
External pilot operating regulators. This control type requires an external supply of auxiliary air, non-corrosive gas, water, oil, or other liquid under pressure to actuate the main valve. The impulse from the controlled variable is transmitted to and operates the pilot which in turn varies the supply of auxiliary pressure to position the main valve. The external pilot operating regulators are more accurate than the direct operated types and are more suitable to high pressure applications.

Power Element

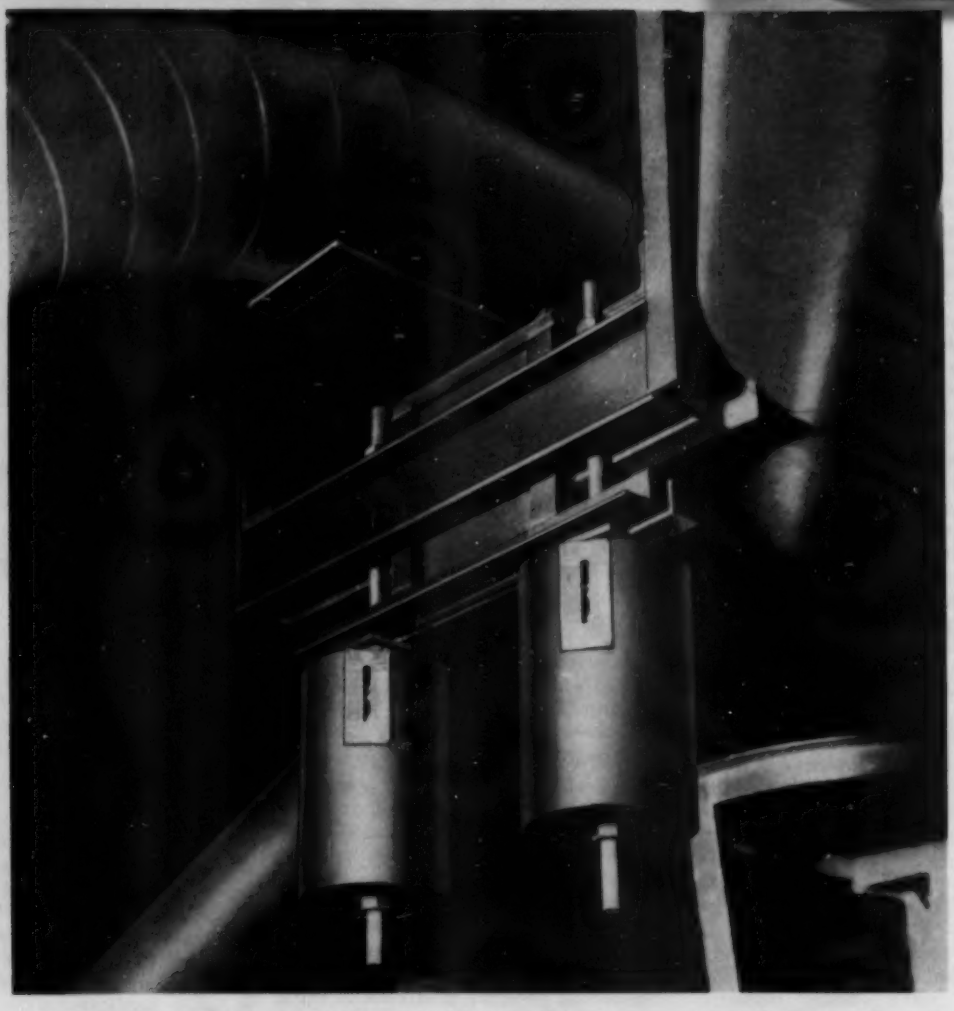
The selection of the medium for the power element of external pilot operating centrifugal pump controls merits special consideration. Controls operated by a liquid have a somewhat slower response to controlled variable changes than the air or gas operated types. The former are particularly valuable where very large main valves are used and where the power required to operate them is more readily available from hydraulic pressure than from the usual compressed air system. At the same time, reliability considerations must be given full weight in the selection of the power medium for operating controls.

Electrically-Operated Controls

Electrically operated valve controls are generally available either in the semi-automatic or in the fully automatic types. For both, an electrically operated valve consists of a reversing torque motor driving the valve stem through a train of gears. The motor control is arranged to stop the valve in a full closed or full open position as well as in any intermediate position.



Characteristics of flow curves for various types of valves. A straight line characteristic valve is preferred for accurate and sensitive regulation.



This hanger suspension gave the designer a few headaches because of the piping interferences.

Selecting Proper Pipe Hangers

The rigid, variable spring, and constant support hanger each has its specific place when used for supporting piping systems. The author outlines the factors, both pro and con, that should influence the choice of hangers for different applications.

NORMAN C. STEWART
Pipe Suspension Department
Grinnell Co., Inc.

SOME BASIC CONSIDERATIONS in the selection of pipe hangers are as follows:

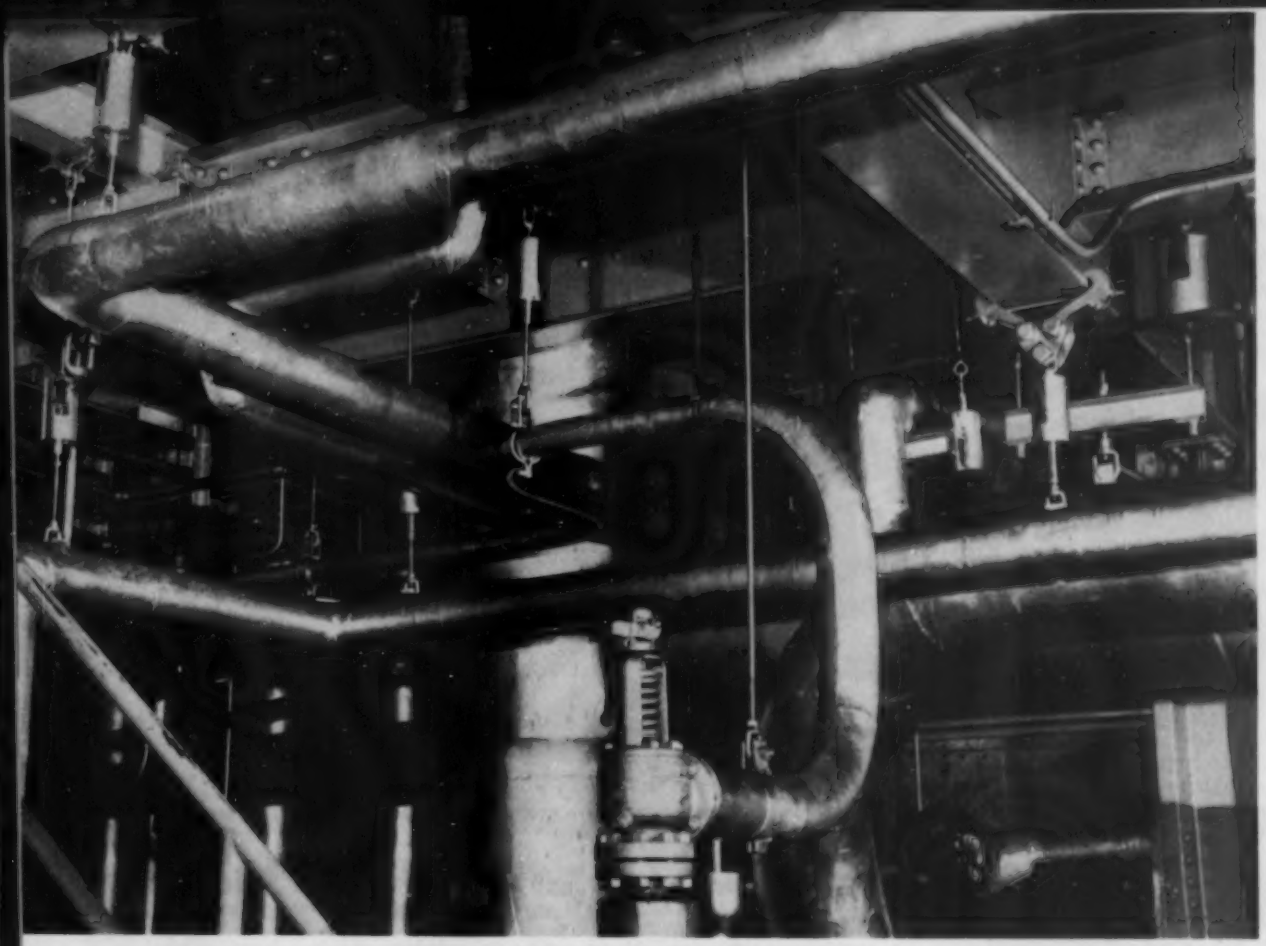
¶ The weight to be supported—including pipe, valves, insulation, flanges, and fittings, as well as the weight of the transported fluid (when this is an appreciable part of the total weight).

¶ The maximum temperature of the system as it affects the choice of hanger material.

¶ Temperature changes and the amount of movement that results from thermal expansions and contractions.

¶ Existing structural or other physical interferences.

The rigid hanger is the simplest of the pipe hangers. It is used when no vertical movement is expected in the system being supported. The rigid hanger assembly consists of three basic parts: A structural or building



Pre-engineered hangers are frequently found in power house locations as suspensions for high temperature piping systems.

attachment such as a beam clamp, concrete insert, or welded bracket; the piping system attachment, either some form of pipe clamp or a clevis attached to a structural member; an intermediate, generally a steel rod, to link together the other components of the system.

Rigid hangers, properly used, have several advantages. Initial cost is low, and they seldom require maintenance or servicing. A capable maintenance man or pipe fitter can install any rigid hanger. There is little danger of a stress failure because most of the hanger components are designed with a minimum safety factor of five. Also, it is highly improbable that an entire system would collapse because of the freak failure of one hanger.

Variable Hanger

A variable spring hanger may be used—when vertical movement does not exceed ½ in.—on high temperature systems and boiler feed piping; or for general application on non-critical systems such as condensate piping for example.

The essential element of the variable spring hanger is a simple compression spring which provides the necessary support during and after a change in vertical position of the pipe. A load turnbuckle facilitates adjusting the spring for the desired deflection. Metal plates are commonly used to show inches of deflection along with the corresponding spring supporting force in pounds. The compression spring is fully enclosed and guided to insure proper spring travel. The variable spring hanger is designed as a compact unit with accurate and reliable load movement characteristics.

As an example, to choose the correct variable spring hanger and make the necessary spring adjustment for a calculated load of 1500 lbs and an expected movement of ½ in. upward at the hanger position, a hanger is selected from a manufacturer's catalog with a spring range that approximately brackets the 1500 lb load, say roughly 1000 to 2000 lbs. This particular size hanger may be assumed to have a spring scale of about 350 lbs per in. Therefore, the variation of load imposed on the hanger by the ½ in. system movement equals the spring scale times the movement, (350 lbs per in.) x (.5 in.), or 175 lbs. of load difference.

The pipe and hanger will move up under operating conditions, decreasing the total spring deflection and its supporting force. Consequently, the spring is adjusted to support 1675 lbs (1500 lbs plus 175 lbs) in the cold or as-installed position. At the operating temperatures, the system will move up ½ in., and the hanger will then carry the desired 1500 lb load.

In this particular illustration, the deflection was small enough so the working range of the spring wasn't exceeded. As long as the total load on the hanger remains within the spring deflection range, it will function as a variable spring hanger. However, if the total load exceeds the maximum limit of the spring, it will act as a rigid hanger. Therefore, if the characteristics of the variable spring hanger are desired, it is important to determine whether the piping system load and variation in support are within the range of the selected hanger spring.

Although the variable spring hanger has a higher initial cost than the rigid hanger, it has the advantage that it can well be used for systems

with limited vertical motion. Variable spring hanger seldom require maintenance or servicing. Similar to the rigid hanger, the components of variable spring hangers are designed with a minimum safety factor of five. However, the unit fibre stress on the spring should not exceed 100,000 lbs ultimate. It should be emphasized that the additional load that any hanger can support is limited by the weakest part of the assembly.

Constant Support Hangers

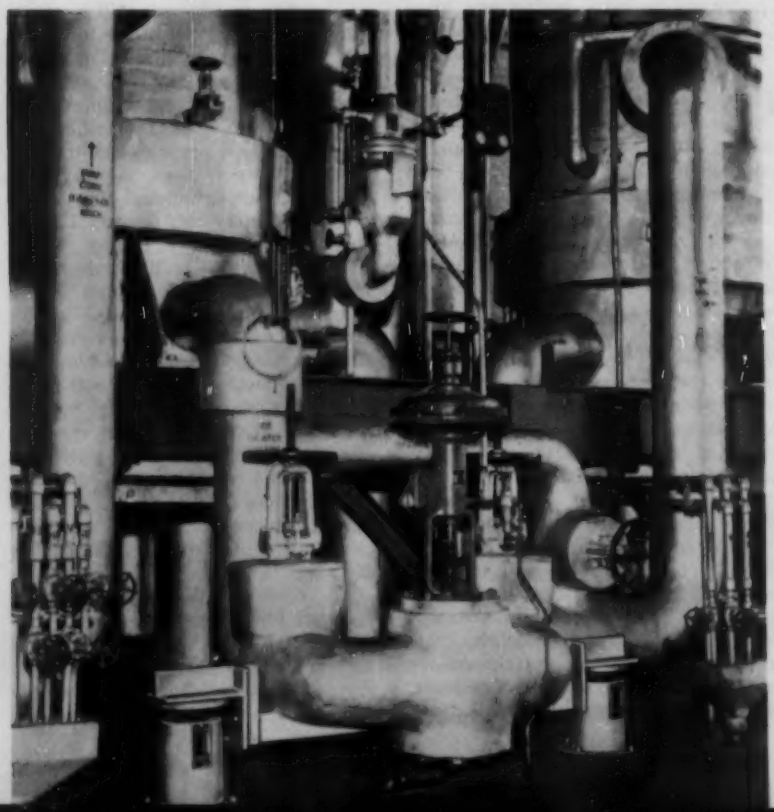
Constant support hangers incorporate a combination of levers, linkages, and springs in their design to give a constant supporting force throughout the entire range of vertical movement. They are most generally used with high temperature, high pressure systems, such as main steam or reheat lines. Constant support hangers are far more compact, economical, and efficient than previous supporting methods using custom built counterweights.

The constant support hanger is individually calibrated and adjusted to support the exact specified load. Further field adjustments can be made without difficulty. These hangers are commercially available.

Hanger designs and types are available for almost any pipe support problem.

Other Problems

Other specialized problems may affect final design. Extremely cramped locations, beneath turbine foundations for example,—where systems must be run in limited spaces—often necessitate the use of trapeze hangers or special yokes. Abnormally high horizontal movements coupled with low headroom may require the use of trolleys to provide for movement in one or two directions. Occasionally, when large horizontal movements in two directions are expected and a trolley is required, the supporting beam for this trolley can be designed to follow the vector resulting from the two movements so that a single directional trolley can be used. This may reduce the initial cost of the installation substantially.



Selection

While the primary considerations in the selection of pipe hangers are the basic requirements of weight, operating temperatures, and structural interferences, other factors, such as individual preference and the relative importance of the piping system being supported, should and do influence the final design. In general, the more flexible the components of a hanger assembly, the higher the initial cost. This increase in cost may be justified by the resultant consolidation of inventory. The use of constant support hangers often results in lower over-all costs for an installation.

Pipe hangers are not always hung from ceilings. Two used in this power plant "suspend" from below.

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Actual photographs show amounts of carbon residue left after dropping equal quantities of Solnus and two other oils on steel plates and baking in a closed oven at 500°F for 24 hours. The three oils all had viscosities of 300 SUS at 100°F.

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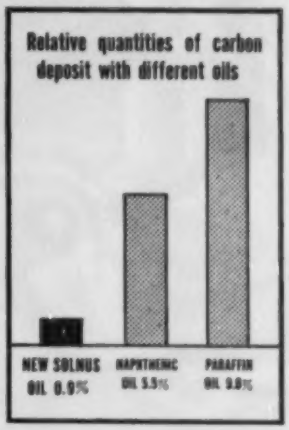

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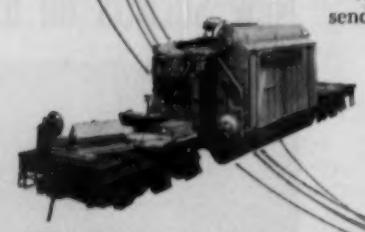
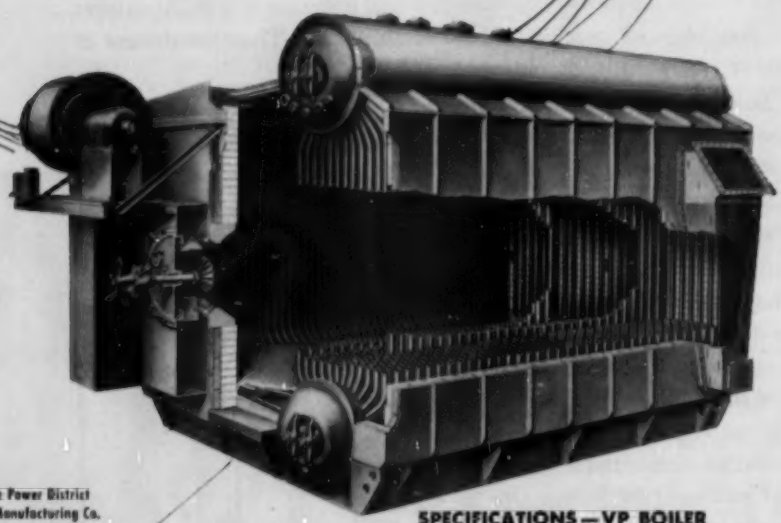
There's significance in that fact for you. It's quite likely that all of these buyers knew that there are many "package" boilers on the market. They probably knew, too, that most of them *look* pretty much alike. But they *bought* the VP — the package boiler with *extra* features. Could be that they liked the idea, too, of buying a *small* boiler from the same company that has designed and built many of the *largest* boilers in the world.

Why not look into this VP Boiler and its *extra* features? Let us send you Catalog VP 233 which describes it in detail.

B-7120





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Bell Telephone Laboratories, Inc.
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Cabin Crafts, Inc.
Cardinal Glennon Memorial Hospital
Central of Georgia Railway Co.
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Consolidated Bleaching Company
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General Motors Interamerica Corp.
Gulf Menhaden Company
Hockmeyer Brothers, Inc.
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Mathieson Alabama Chemical Corp.
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New York Life Insurance Co.
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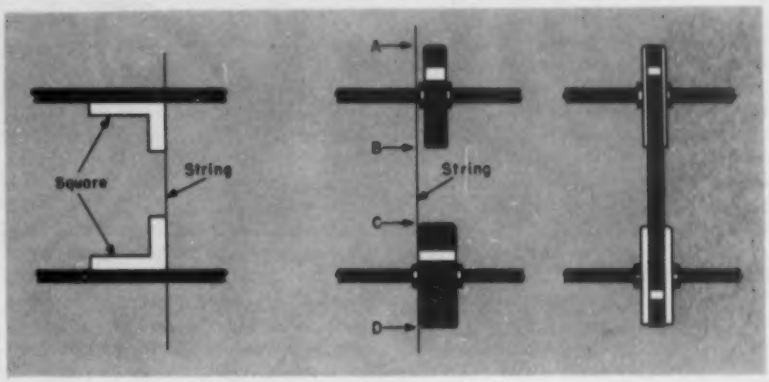
Installing Leather Belts

BETTER BELT PERFORMANCE is assured by taking the time to check alignment, tension, and other details before starting up a leather belt drive. An easy method of aligning shafting and pulleys is shown at the right. The procedure follows in this order:

1. Check shafts with a level.
2. Determine if shafts are parallel by placing a taut string between the shafts and checking it with a large square.
3. Check alignment of pulleys using string along the edges. If pulleys are the same width, string should touch lightly at four points: A, B, C, and D. If pulleys are of different widths, distance from string to pulley at points A and B should be the same. If possible, give pulley half a turn and recheck. When pulleys are installed one above the other, a string with plumb bob can be used to check alignment.



Illustrating methods described in text for aligning shafting and pulleys.

Belt Tension

For best results, a leather belt should be run with the least tension needed to transmit the load without slipping. If a belt is too slack, it will slip, causing its surface to glaze, then crack and peel. If it is too tight, it may put excessive loads on the bearings.

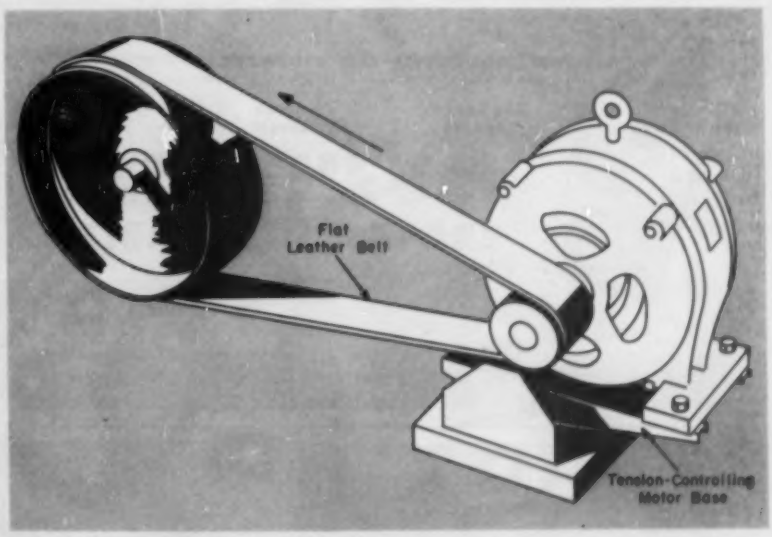
Flat leather belts should be operated—wherever possible—with the slack side on top. This will provide a greater arc of contact between belt and faces of the pulleys, permitting lower tension. On short-center or vertical drives, a pivoted motor base can be used.

Maximum pulling power is obtained by running the grain or hair side of the belt next to the pulley faces when being installed.

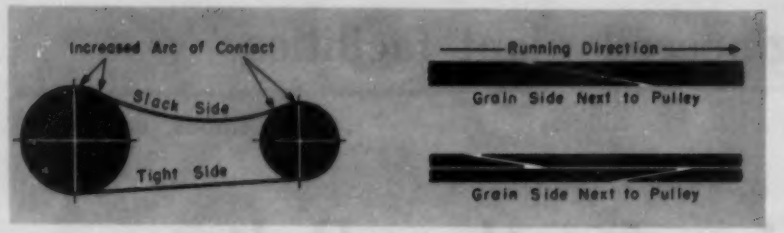
Endless Belts

To make endless leather belts on the job, first shorten pulley center of distances to the minimum. Then, take a steel tape measurement around the pulleys. The usual practice is to reduce this length by about ⅛ inch per foot to provide adequate belt tension. To the resulting dimension is added the allowance for lap length on single ply belts or lap plus break length for double ply belts. This will give the length of belting to be cut from the roll for the new belt. Never cut a new belt to length by using the old belt for a sample.

Care must be used in forcing an endless belt over the pulleys to avoid putting a crook in it. Belts, particu-



Gravity and motor torque reaction adjust base to maintain proper tension.



Operate belt with slack side on top and lap faced away from running direction.

larly those six inches and wider should either be made endless on the job by means of clamps and rods, or slipped on after temporarily shortening the distance between pulleys.

Field splices of double ply belts are sometimes made in the same manner as those of single ply belts. This type of a splice is somewhat easier and less costly to make than the standard one illustrated. While it is satisfactory for many jobs, it may result in a somewhat weaker and stiffer joint.

Care should be taken to have the outside feather edge of the lap faced away from the direction in which the belt runs. This tends to protect the outside points of the lap if they should strike guards, guides, or shifters. It also protects the lap from being opened up by windage.

To overcome the belt distortion encountered in a quarter turn drive, and to distribute wear evenly on both sides, a half turn (180 degrees) should be given on the end of the belt before making the splice. In a single ply belt made up in this way, the grain side at the joint is adjacent to the flesh side. This half-turn method of construction is particularly adaptable to double ply belts which have the grain exposed on both sides. The turning of the belt from side to side, also turns it edge to edge, with the result that not only is the wear distributed on the face of the belt, but the tension is also kept equalized on the edges of the belt itself.

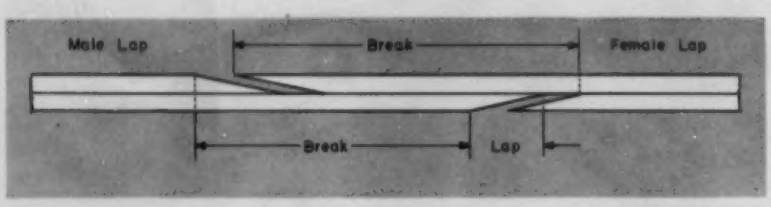
When installing quarter-turn drives, it is particularly advantageous to make the belts endless, with clamps and rods, right on the job. Better production, fewer shutdowns, and longer belt life will result using endless installations.

TABLE 1 — SINGLE BELT ALLOWANCES

Width of Belt	*Lap Length*	*Allowance to be Added*
Up to 3½ in.	4 in.	4 in.
4 to 10 in.	5 in.	5 in.
Over 10 in.	6 in.	6 in.

TABLE 2 — DOUBLE BELT ALLOWANCES

Width of Belt	*Lap Length Per Ply*	*Break Length*	*Allowance to be Added*
Under 8 in.	4 in.	8 in.	12 in.
8 to 10 in.	4 in.	10 in.	14 in.
12 to 18 in.	4 in.	16 in.	20 in.
Over 18 in.	4 in.	20 in.	24 in.



The distance between the grain points of a double belt is called the break.

Maintenance Pointers

When pulley faces begin to polish, it is a sign that dressing is needed on the belt. Under normal conditions, dress belts every three to six months. Best results are usually obtained by using belt dressing sparingly but frequently.

Belts should be kept clean at all times. Oil or grease thrown from machine bearings will reduce belt life and pulling power. If a leak cannot be stopped at the source, the installation of deflectors or throwing disks may prove helpful.

A small amount of oil on a belt can sometimes be removed by ordinary wiping. If this does not suffice, the belt can be given a thorough scrubbing with a solution of carbon tetrachloride and naphtha, using a stiff jute brush and working in the direction of lap joints so as not to lift them apart.

On flanged or step-cone pulleys, belts frequently have a tendency to climb. A simple method for correcting this condition is by machining or undercutting the fillet.

When belts run off the center of motor pulleys it may be due to a worn crown. Fibre pulleys can be recrowned when the wear becomes noticeable.

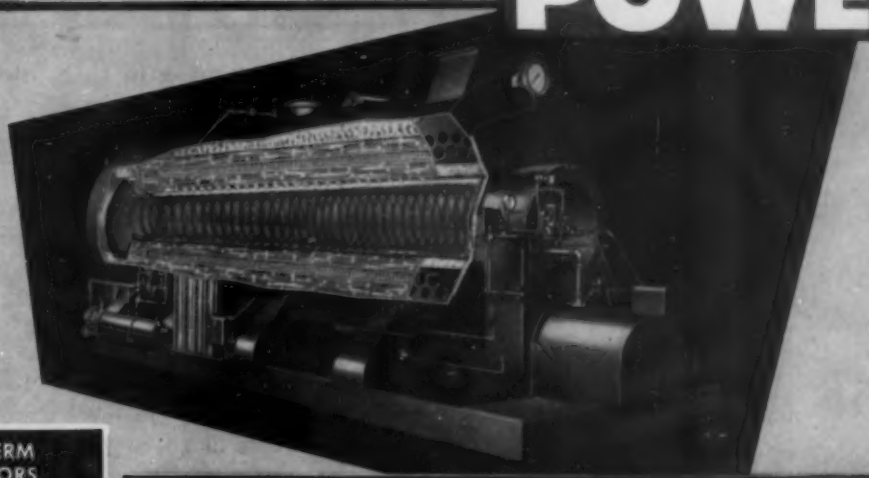
If blisters occur on a belt and an immediate shutdown for repair is impossible, the blister can be punctured with a knife or awl on the trailing end. Travel of the belt over the pulley will then flatten out the blister and it can be cemented when time is available.

If belt guards, shifters, guides, or pulley flanges rub against the edge of the belt, laps and plies may open up. This condition should be corrected immediately. A good belt shifter has broad and well-rounded surfaces so as to spread thrust over a large, belt-edge area.

Another cause of ply and lap separation is running too thick a belt on a small pulley.

Based on a publication of the American Leather Belting Association.

66% more steam generating POWER



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Cyclonic Combustion is the revolutionary new flame control that reduces heating surface requirements from 5 to just 3 sq. ft. per boiler horsepower . . . to produce 66% more steam generating power per sq. ft.

Used exclusively in Cyclotherm Steam Generators, Cyclonic Combustion controls flame characteristics in a revolving spiral vortex traveling the full length of the combustion chamber. The cyclonic flame constantly heats every part of the chamber, itself a complete heat transfer unit. 65 to 75% of the heat transfer is obtained in the chamber, with the result that only one return pass is required to deliver a guaranteed minimum efficiency of 80%.

The high efficiency of Cyclonic Combustion, plus simple compact design enables Cyclotherm generators, complete with fiber glass insulation, to save up to ⅓ the space of conventional package steam generators.

Cyclotherm generators operate on gas, oil or a combination of both. Complete combustion of fuel particles in the combustion chamber results in greater fuel savings and eliminates the need for extensive stack facilities. Inspection and cleaning is a minor operation with no time loss caused by boiler shutdown.

Cyclotherm arrives complete . . . 5 easy connections—fuel, electricity, water, steam and a simple flue—and Cyclotherm is ready to generate steam for any purpose. Full power operation from a cold start in 15 to 20 minutes. Boilers are designed for 18 to 500 h.p., 15 to 200 psi pressures.

The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters Laboratories, Inc.

Proved superior in thousands of installations, Cyclotherm steam generators with Cyclonic Combustion offer the most efficient and compact package steam generator on the market today. Write today for the free illustrated folder.

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CYCLOTHERM STEAM GENERATORS

Cyclotherm Division U. S. Radiator Corp.
Dept. 38
Oswego, New York

☐ Please send without obligation my copy of "All Your Questions Are Answered by Cyclotherm."

☐ Please send a Cyclotherm representative to speak to me about Cyclotherm.

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FIRM_____

ADDRESS_____

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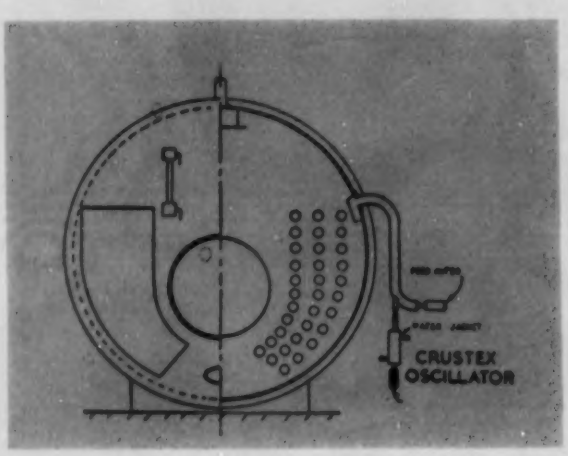
spot news

. . . what's happening in U. S. industrial plants



Ultrasonic Energy Prevents Boiler Scale Buildup

Ultrasonic energy now in common use for such applications as the coagulation of smoke and other suspended solids and the detection of flaws in metal is said to have been successfully applied to the problem of boiler water scale.

It has been found that ultrasonic vibrations transmitted through boiler water prevent the build up of thick layers of hard crystals of scale. This principle is used by the Crustex boiler descaler, invented and manufactured by H. R. Hilfiker & Co. of Switzerland.

The unit consists of two parts, the generator and the oscillator. The former, a simple rectifying circuit, supplies pulses of direct current to an oscillatory circuit composed of a condenser and a solenoid.

Thicker layers of scale formed at inaccessible parts of the boiler prior to installation of Crustex are also said to be dislodged. Some measure of protection from corrosion is afforded by the thin layer of scale not dislodged by vibration.

According to the American representatives, Stamford Scientific Corp., One Factory Rd., Stamford, Conn., the unit has practically unlimited life, and in its present stage of development can be used for boilers with up to 450 psi.

Dry Charge Batteries Will Be Available Soon

Industrial storage battery users will soon have available a new dry-charge type battery which is said to keep indefinitely for stand-by without suffering deterioration.

According to the manufacturer, Gould-National Batteries, Inc., tests indicate that the "soaking-period" or time required to bring the battery up to operating level is a fraction of that required by present batteries. Even submarine batteries, the largest built, after a long period of idleness can be brought up to charge in the time required to uncover the engines. The present type takes several days to recharge.

Another advantage will be the savings realized from the reduction or elimination of charging facilities for large installations.

The new type, over a period of time, will be made available in sizes for every application now using standard type batteries.

"Atoms for Peace," Theme Of Exposition and Congress

To bring together the tremendous amounts of nuclear energy information now de-classified, the Nuclear Engineering Div. of the American Institute of Chemical Engineers is sponsoring a Nuclear Engineering Congress at the University of Michigan, June 20-25.

It will consist of a series of five daily technical sessions, in which leading scientists in nuclear energy will present papers summarizing the results of their research.

In conjunction with this meeting, which is to be held at the Rackham School of Graduate Studies, it is planned to hold an "Atoms for Peace" Exposition in the Art Galleries of the Rackham Building. Since the purpose of this exposition is primarily educational, representative exhibits in the following fields will be on display: academic, government contractors, instrument manufacturers, and equipment manufacturers.

Further information is available from "Atoms for Peace" Exposition, C. M. Sliepcevich, Chairman, 3030 Rackham Bldg., Ann Arbor, Mich.

Wrap-Around Method Cuts Installation Time

The application of one-inch-thick mineral fiber felt insulation on almost 10,000 sq ft of heating and ventilating ducts at the University of Toledo Library demonstrates the economies achieved with the wrap-around method according to the Industrial Mineral Fiber Institute. Flexibility and high tensile strength of the

NEW "Small" boiler is a Big Quality package!

Available up to 80 hp — heating or processing — steam or hot water. A complete unit from a single source.

CLEAVER-BROOKS modern CB boiler

NO BOILER HAS EVER OFFERED SO MANY ADVANTAGES AND QUALITY FEATURES AT SUCH LOW INITIAL COST

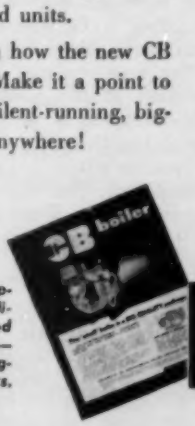
• This NEW CB boiler has EVERYTHING needed to bring *big boiler standards* to commercial, industrial and institutional users with small capacity requirements. Despite its unusual, compact size you get big boiler performance — from matched-quality components, proved the world over on thousands of Cleaver-Brooks self-contained units.

Get all the facts NOW on how the new CB can help you save dollars. Make it a point to see . . . and *hear* the most silent-running, biggest boiler value available anywhere!

gives you all the quality features of time-tested self-contained design

- **FOUR-PASS FIRETUBE CONSTRUCTION** — longer gas travel scrubs heat from flame — means lower fuel costs — guaranteed efficiency of 80% when firing with oil.
- **SILENT OPERATION** — even at peak load this boiler more than meets the low sound levels required for schools, hospitals, institutions.
- **FULL FIVE SQUARE FEET** — of heating surface per boiler hp — for longer service life and low maintenance.
- **FUEL FLEXIBILITY** — burns available light oil, gas, or combination oil/gas — simple, quick fuel changeover on oil/gas models.
- **FAST, EASY MAINTENANCE** — front and rear doors hinged for fast inspection, cleaning or servicing boiler.
- **AUTOMATIC SAFE OPERATION** — all controls centralized and conveniently located — modern electronic combustion control is standard equipment.
- **COOLER BOILER ROOM** — fiber glass blanket insulation and 16 gauge metal sectional lagging are non-corrosive, moisture and heat resistant.
- **FULLY APPROVED** — by Underwriter Laboratories; conforms to ASME codes; factory tested before shipment.

Call your nearest CB boiler representative (see your phone directory) or send for this illustrated catalog describing the NEW CB — designed by Cleaver-Brooks, originators of self-contained boilers.



Cleaver Brooks

Cleaver-Brooks Company, Dept. F-302, E. Keefe Ave., Milwaukee 12, Wisconsin

Originators of the Self-Contained Boiler

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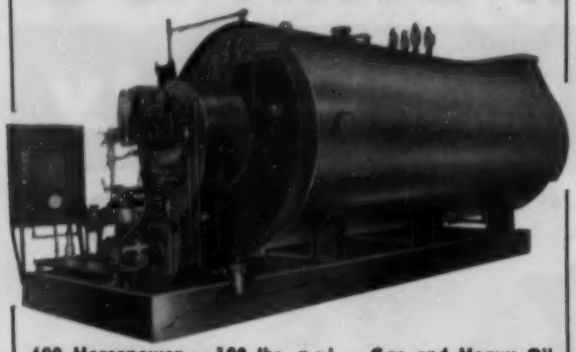
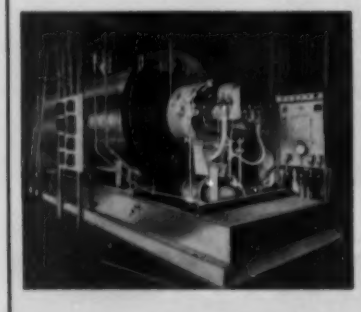
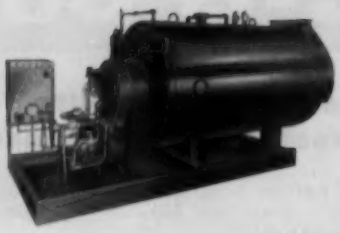


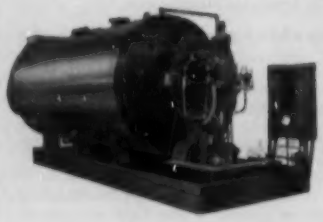
600 Horsepower — 100 lbs. p.s.i. — Gas and Heavy Oil



375 Horsepower
15 lbs. p.s.i.
No. 6 Heavy Oil

125 Horsepower
125 lbs. Pressure
Natural Gas Fuel





500 Horsepower
15 lbs. p.s.i.
Heavy Oil

Fully Automatic — Heavy Oil, Light Oil or Gas.
60 to 600 Horsepower — Capacity Guaranteed.
15 lbs. to 250 lbs. pressure — A.S.M.E. Code.
Completely Equipped and Tested at Factory.
Underwriters Laboratory and Factory Mutual Approved.
Serviced by nearby, factory trained Engineers.

Johnston Brothers, Inc.

FERRYSBURG, MICHIGAN
Established 1864

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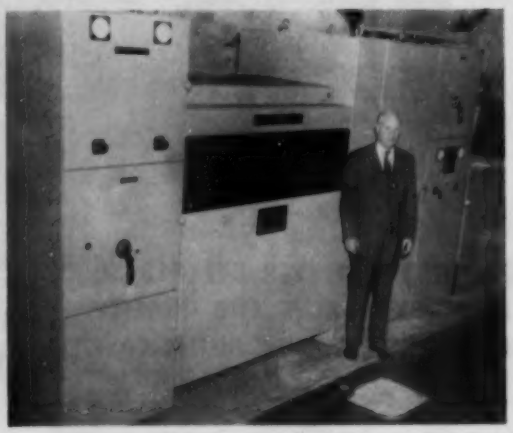
spot news

—Starts on page 108

36-inch-wide felt insulation permit the applicators to slide the material through small openings and around sharp corners of ducts rapidly and without damage. Because the width of the horizontal ducts varies, each length of insulation is individually cut from the 100-ft-long roll to the exact circumference of the duct.

Adhesive is brushed onto the duct at about 12-in. intervals. Insulation is then applied over the adhesive with the edges tightly butted. Speed clips or insulation pins are spaced along the underside of wide ducts to provide extra support of the insulation and wires are wound around the duct near both edges of each felt section. Joints are then sealed with 4-in. tape. Other successful methods of fastening mineral fiber felt insulation include the use of staples and cord.



Rectifier Unit Replaces Diesel Generator Sets

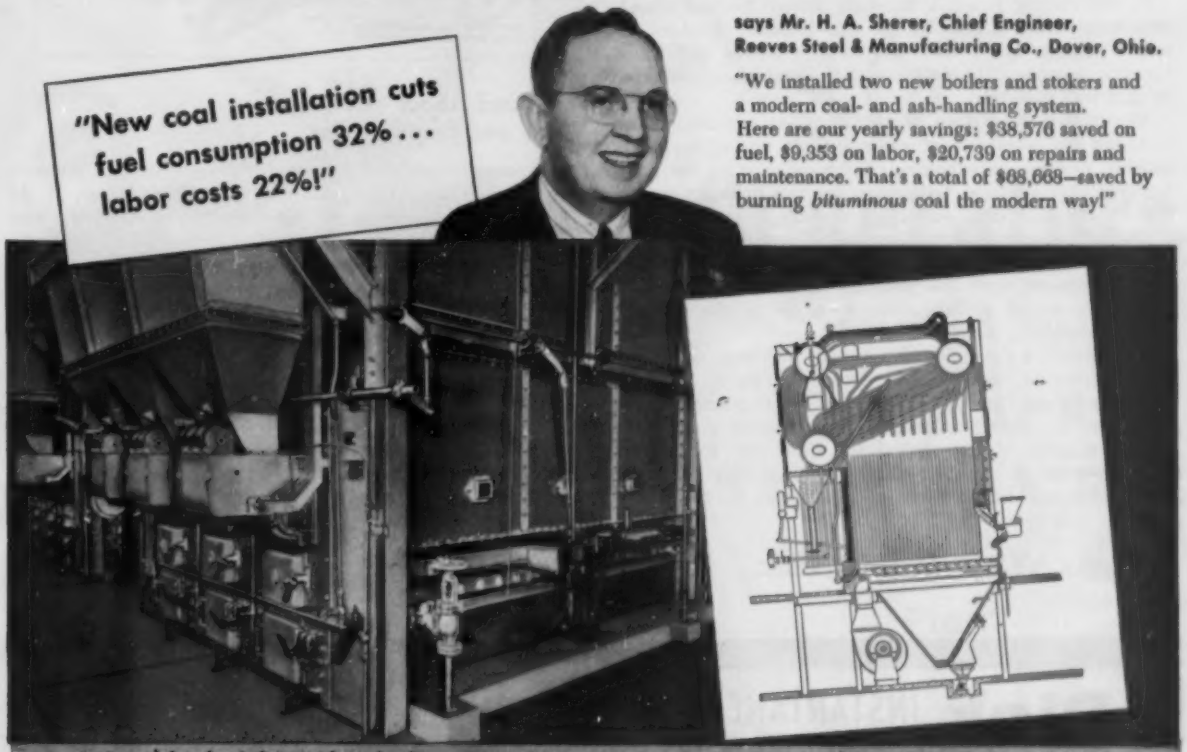
The New York, Ontario & Western's recently installed General Electric mercury arc rectifier has been saving the company over $1000 a month in operating costs, according to G. Bennett, Chief of Motive Power for the company, shown here in front of the new unit. The rectifier unit replaced two diesel generator sets and associated control panels in the railroad's main shop at Middletown, N. Y.

Because it has the overload capacity to handle peak load, the rectifier's installed capacity could be less than the old equipment. The biggest money saving, however, resulted from the fact that the new equipment does not require the constant presence of operating personnel.

Oil Spray Reduces Air Pollution From Coal Processing

Use of oil spray to further improve the control of airborne wastes at the Disco Co. coked pellet plant has been successfully achieved by cooperative action of the

"WE SAVE OVER $68,000 A YEAR— BY BURNING COAL THE MODERN WAY!"



says Mr. H. A. Sherer, Chief Engineer, Reeves Steel & Manufacturing Co., Dover, Ohio.

"We installed two new boilers and stokers and a modern coal- and ash-handling system. Here are our yearly savings: $38,576 saved on fuel, $9,353 on labor, $20,739 on repairs and maintenance. That's a total of $68,668—saved by burning *bituminous* coal the modern way!"

A view of the plant's firing aisle and a diagrammatic drawing of one of the boilers. It now costs 18.8¢ less to generate every thousand lbs. of steam. This is a saving large enough to amortize the entire installation in 3 years-3 months. And that includes all the cost incurred in tearing out old equipment and constructing a new plant floor!

● Today, *bituminous* coal's inherent economy has been greatly increased. Modern combustion installations give you more steam for every dollar . . . automatic coal- and ash-handling systems cut labor costs to a minimum.

A consulting engineer can show you how coal can do a better job—*and save you real money*—in a plant designed to meet your *specific* needs.

In addition, with coal you get the basic advantages of price stability, and dependable supply. These advantages are assured by America's virtually inexhaustible coal reserves and the high productivity of America's coal industry.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

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spot news

—Starts on page 108

company, a division of Pittsburgh Consolidation Coal Co., and Gulf Oil Corp. laboratories.

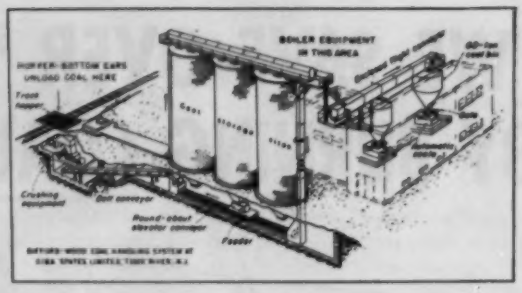
In the coking process, crushed Disco (called fines) recovered from screening of the finished product is mixed with crushed coal, heated in roasters and kilns for low temperature carbonization, and then reduced in size by crushing.

Mechanical measures to prevent dust emission are installed at a number of these points. In one of the most difficult phases—satisfactory control of dust in the preheating ovens where temperatures are brought up to 600 F—cyclonic dust collectors are used.

The oil apparently functions by coating the powdered fines and coal so that all dust is held on the surface and carbonized with the product. A certain amount of product is saved in this manner, reducing the cost of the treatment.

In addition, a further reduction in exposure of bearings, conveyors, and belts to dust abrasion appears likely to assure considerably longer life to plant equipment and to generally reduce maintenance costs.

Four months of test operations show the spray has nearly perfected the pollution control picture and resulted in a new high degree of cleanliness for an operation of this type.



"Round-About" Conveyor Fills and Empties Silos

Unusual feature of the coal handling system at the new dyestuffs plant of Ciba States, Ltd., Toms River, N. J., is a 276 ft "round-about" conveyor which both fills and empties powerhouse coal silos.

Built by the Gifford-Wood Co., the conveyor travels over and under three 330-ton-capacity silos. It acts as a bucket conveyor when ascending and as a flight conveyor when traveling horizontally.

Incoming coal is picked up by the ascending section and discharged during horizontal travel across the top of the silos.

Silos empty onto the "round-about" as it travels beneath them. Coal is carried up and across the silos and delivered to a flight conveyor which feeds 60-ton-capacity bins supplying coal to boiler furnaces. Thus, one conveyor handles all coal into or out of the silos.

Pick INSTANTANEOUS HOT WATER HEATERS

ENGINEERED FOR SERVICE

Industries everywhere are replacing outmoded water heaters with Pick Instantaneous Water Heaters. Here are the reasons:

★ Water Is Heated Instantly. Entirely automatic, Pick Heaters operate by steam injection to heat the water in a flash to exact temperature desired and in volume required.

★ Fuel Savings Are Substantial. Steam injection heating is the most efficient method known. There's no waste because water is heated only as used . . . never stored and allowed to cool.

★ No Storage Tanks Required. Compact design of Pick Heaters permits out-of-the-way installation in corners, on walls or overhead. Saves valuable floor space.

★ Exact Temperature Control. Pick heaters can be operated at low or high loads with minimum temperature fluctuation. And it's done quietly.

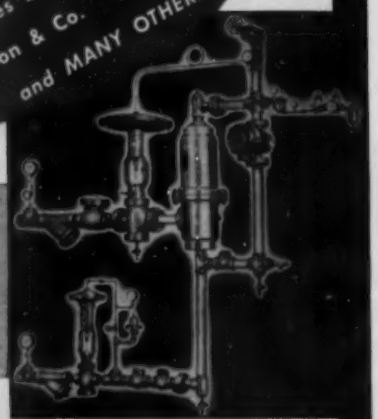
★ Maintenance Cost Is Low. Pick Heaters can be cleaned in a matter of minutes — worn parts easily replaced.

★ Installation Is Inexpensive. Only ordinary pipe connections are required.

PICK HOT WATER HEATERS . . . Used by

- United States Steel Co.
- Ford Motor Co.
- H. J. Heinz
- Bethlehem Steel Corp.
- Hercules Powder
- Wilson & Co.

and MANY OTHERS



SAVES MONEY FOR ANY INDUSTRY THAT USES HOT WATER!

Write for booklet on how PICK HEATERS cut costs of Hot Water — No Obligation. Write 1P354

PICK MANUFACTURING CO. • WEST BEND, WIS.

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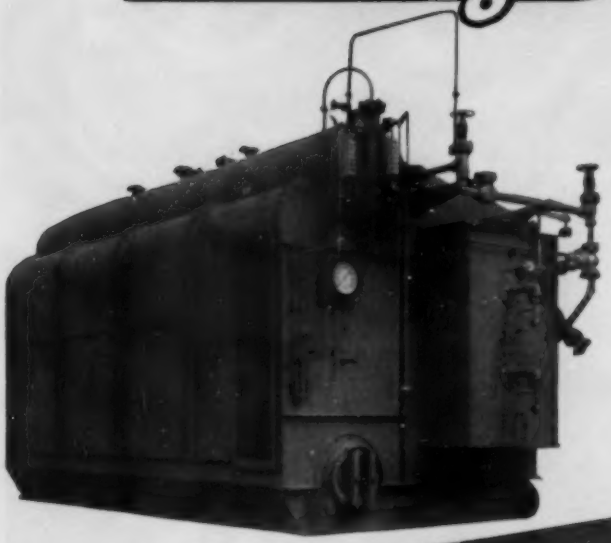
Vogt

Gas Fired
PACKAGE UNIT
Steam Generators
selected by
PHILLIPS CHEMICAL CO.
Pasadena, Texas Plant



TOP: One of the completed units prior to shipment.

BOTTOM: Shop erection view shows tile and block insulation in convection wall; also main baffle tile and furnace floor tile.

Principal Data, Each Unit

25,000 pounds steam per hour capacity. Induced draft type.
Fusion welded steam and water drums designed for 425 pound S.W.P.
Completely shop assembled and required only the piping and gas outlet connections to place them in operation.
Fully steel encased for outdoor installation on a simple foundation.

•

**Vogt Steam Generators are available in bent tube types and straight tube forged sectional header types for solid, liquid or gaseous fuels. Bulletins on request.*

HENRY VOGT MACHINE CO.
Louisville, Kentucky

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

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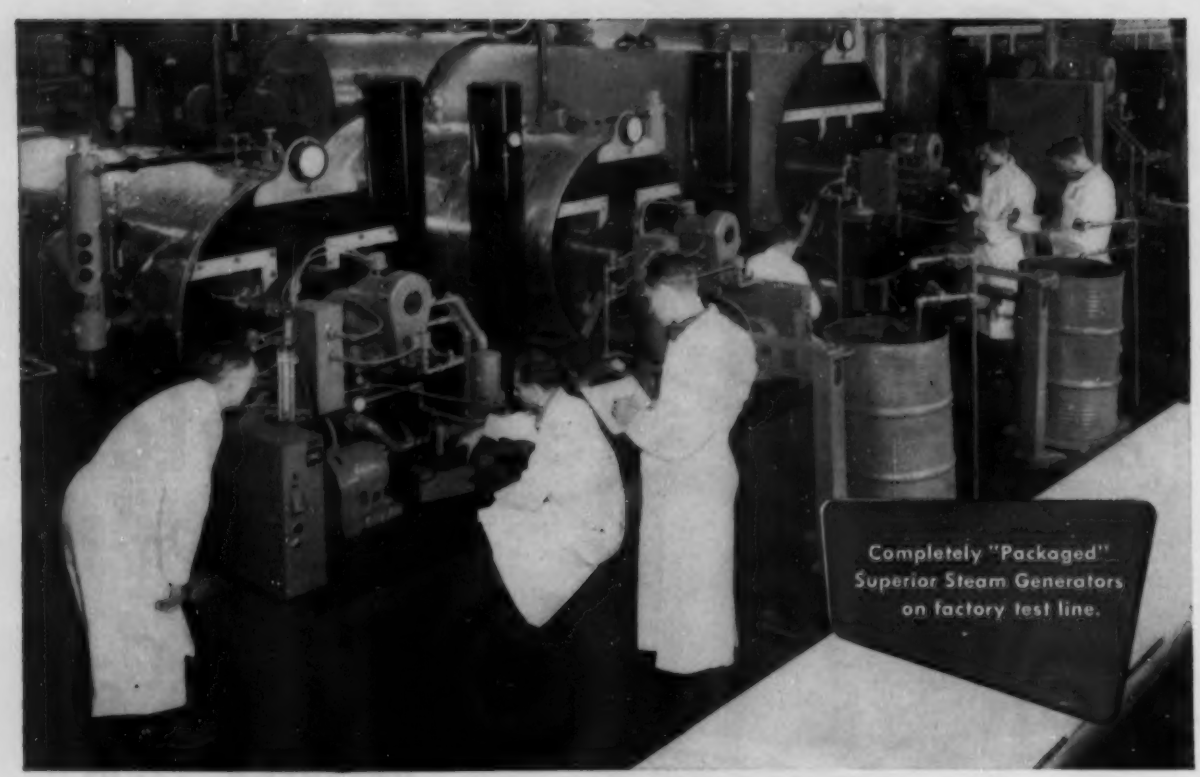
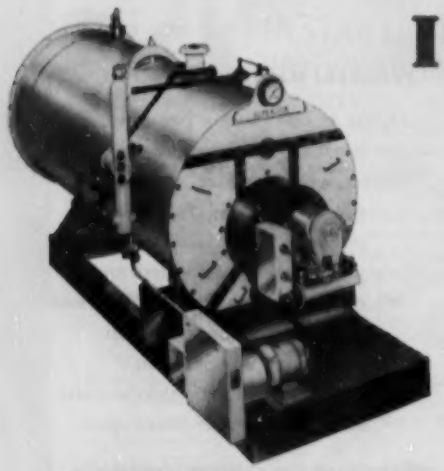


only a TRUE PACKAGED boiler IS TESTED like this.



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 602.

At the Superior factory in Emmaus, Pa., every steam generator is thoroughly tested before shipment. This is one of the outstanding advantages of the *true* packaged steam generator. Completely assembled at the factory with burner and all boiler trim installed, it is set on a testing line, connected to service supplies, and fired. During this test firing period, trained technicians thoroughly check on all points of performance and make whatever adjustments are necessary to bring the unit into top operating condition.

Then, and then only, is a Superior Steam Generator shipped . . . with a written guarantee based on the results of this actual test firing. There's no guesswork about Superior Steam Generators. Every guarantee is based on the actual performance of the unit to which it applies.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N. Y.

SUPERIOR
STEAM GENERATORS

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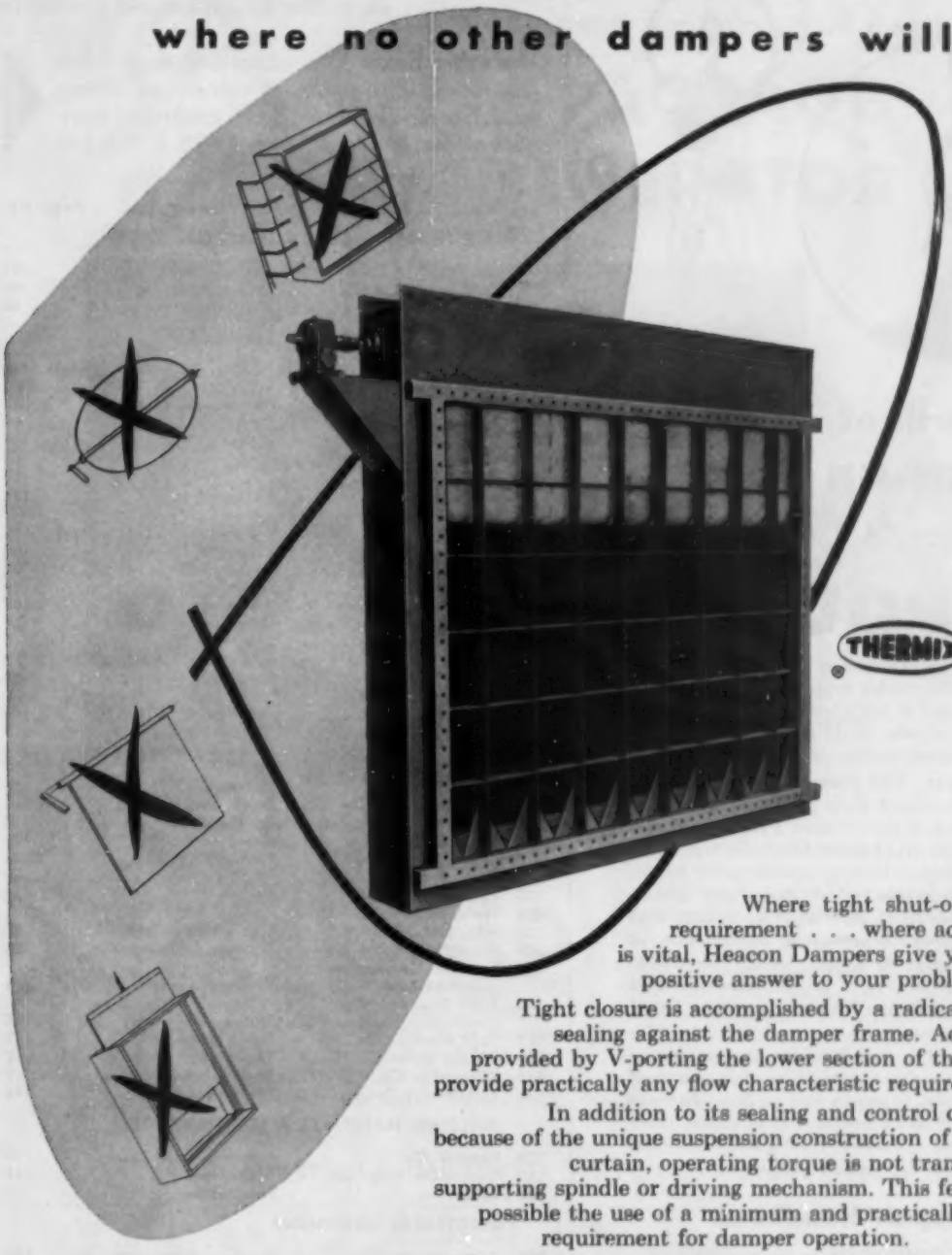
THE FINEST DAMPER THAT MONEY CAN BUY

HEACON DAMPERS *are specified*

where no other dampers will work



Where tight shut-off is an absolute requirement . . . where accurate control is vital, Heacon Dampers give you the only positive answer to your problem.

Tight closure is accomplished by a radical method of sealing against the damper frame. Accurate control is provided by V-porting the lower section of the frame to provide practically any flow characteristic required.

In addition to its sealing and control characteristics, because of the unique suspension construction of the sealing curtain, operating torque is not transmitted to the supporting spindle or driving mechanism. This feature makes possible the use of a minimum and practically constant power requirement for damper operation.

Thermix, Project Engineers for Heacon will be glad to help solve your damper problems. Why not contact them today.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(OFFICES IN 38 PRINCIPAL CITIES)

Canadian Affiliates: T. C. Chown, Ltd. 1440 St. Catherine St. W., Montreal 25, Quebec. 983 Bay St., Toronto 5, Ontario, Canada

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10¢ worth of SMOOTH-ON *supports* 690 POUNDS!

Smooth-On, with its expanding action and iron-hard set, made the joint which supports the load shown —an ash can loaded with iron filings to a total weight of 690 pounds. Only Smooth-On No. 1 is holding that eyebolt in that pipe!

Hundreds of Uses This principle can be used in dozens of ways around both plant and home. By expanding hard and tight within a repair, Smooth-On IRON Cement stops leaks, fills holes and seams in any metal, patches boilers, repairs water jackets and radiators, corrects wobbly bolts and screws, plugs tanks, holds loose parts tight — in fact, does all kinds of things where that combination of strength and expansion can be used. Smooth-On IRON Cement never tires, or softens from age. Years after a repair is made the Smooth-On will be found harder, tighter, stronger.

Keep Smooth-On No. 1 on hand for that emergency repair. It does not deteriorate. Whenever you need it, just mix and fix. It sets in half an hour, hardens to Rockwell R-70 in 24 hours. And of course there is Smooth-On No. 2, a slower-setting IRON Cement but with the same dependable properties.

SO402

FREE Repair Handbook

New, completely revised 48-page illustrated handbook, shows in detail how to make all the repairs referred to here plus dozens of others. Get a copy from your supply house or write us. Sent postpaid.

SMOOTH-ON MANUFACTURING CO.
Dept. 19, 572 Communipaw Avenue, Jersey City 4, N. J.

SMOOTH-ON
THE IRON CEMENT OF MANY USES
Circle 560 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pgs. 34-35 & 114-115

Key No.	Advertiser	Product	Page No.
	AIR FILTERS & DUST COLLECTORS		
583	Northern Blower Co.	Dust collectors	139
537	Prat-Daniel Corp.	Dust collectors	50
531	Western Precipitation Corp.	Dust recovery	44
	BOILERS & BOILER ACCESSORIES		
562	Ames Iron Works Inc.	Packaged steam generators	118
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523	Beckman Inc., Arnold O.	Oxygen analyzers	35
555	Bituminous Coal Institute	Coals	111
566	Boiler Engineering & Supply Co., Inc., Continental Boiler Div.	Packaged boilers	121
585	Cambridge Instrument Co., Inc.	Dissolved O_2 & H_2 analyzers	140
553	Cleaver-Brooks Co.	Packaged boilers	109
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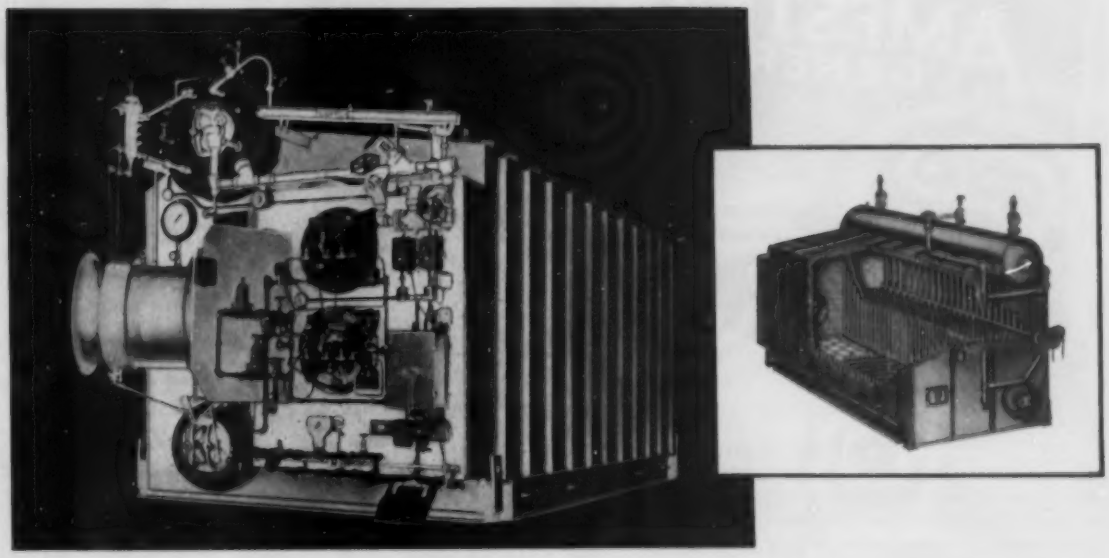
(Continued on page 118)

low-cost steam

where you need it—when you need it

with the **FW PACKAGE STEAM GENERATOR**



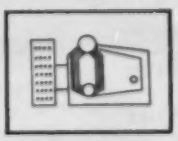
■ Foster Wheeler Package Steam Generators make it possible for you to have 7,500 to 35,000 lb of steam per hr depending on operating conditions. Standard designs for pressures of 250, 525, or 825 psi are available to meet your requirements for an economical source of steam "where you need it—when you need it."

These plant-assembled, water-tube steam generators can easily be transported to your plant by common carrier, set on a simple foundation in a minimum space at the location best suited to your needs, and quickly put in operation after a few simple service connections. For small and medium-size plants a single unit will meet your needs for low-cost heating or process steam. Large plants have found multiple-unit installations to be the economical answer to their requirements up to 150,000 lb per hr.

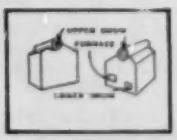
For economy in installation, operation and maintenance, the Foster Wheeler Package Steam Generator offers a combination of features which incorporate many of the improvements and technical advancements of over 50 years of experience in steam generation. For more specific information write to Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

FEATURES THAT DISTINGUISH FOSTER WHEELER PACKAGE STEAM GENERATORS

HIGH STEAM TEMPERATURES. Provisions for superheaters in some designs.



ECONOMIZERS. For large capacity installations, package economizers can be supplied to provide minimum fuel costs.



ACCESSIBILITY. For inspection, cleaning, maintenance.

CLEAN HEATING SURFACES. Soot blowers incorporated . . . cleaning without boiler shutdown.

HEAT LOSS MINIMIZED. Minimum heat loss—from radiation and air infiltration.

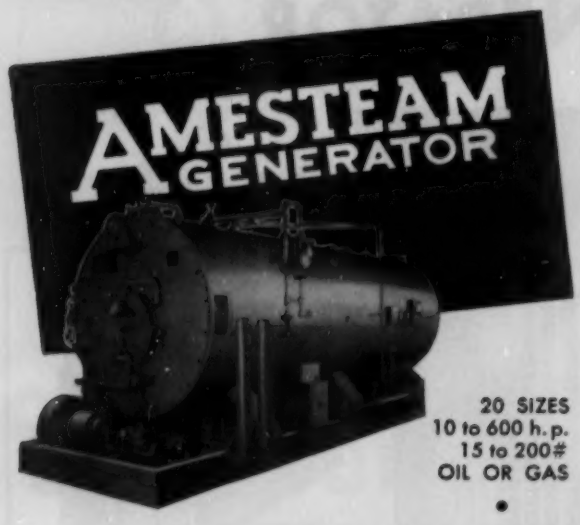
RAPID LOAD SWINGS. Large diameter drums and ample furnace heating surface.

FOSTER WHEELER

Circle 561 on Reply Card for more data

REAL SAVINGS

in installation . . . in operation with these "PACKAGED" BOILERS



20 SIZES
10 to 600 h.p.
15 to 200#
OIL OR GAS

•

JUST SET IT ON YOUR CONCRETE FLOOR — no special foundation or heavy stack are needed. You make BIG savings on installation of AMESTEAM GENERATOR because it's a complete, self-contained unit, ready to start generating steam!

FULLY AUTOMATIC . . . TROUBLE-FREE! Set it and forget it. No more continual dirt, dust and ashes. Models for oil or for gas, or combination units for either fuel.

EASY TO CLEAN! EASY TO GET AT! Davit-hinged doors at rear give quick access to furnace and all tubes — and look at the space under the shell!

COMPLETE SERVICE! Our LOCAL service man starts your unit and gives you three months' FREE service.

Write for FREE bulletin TODAY!

AMES IRON WORKS
Box F-54 Oswego, N. Y.
Gentlemen:
Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

NAME.....
COMPANY.....
ADDRESS.....

AMES IRON WORKS INC.

BOX F-54 **OSWEGO, N. Y.**

Circle 562 on Reply Card for more data

readers' guide

—Starts on page 116

Circle key numbers on Reply Cards for more data

Key No.	Advertiser	Product	Page No.
	ENGINES & TURBINES		
548	Coppus Engineering Corp.	Steam turbines	61
517	Murray Iron Works Co.	Turbo-generator	28
530	Terry Steam Turbine Co., The	Solid-wheel turbine	43
	FANS & BLOWERS		
507	Diamond Power Specialty Corp.	Soot blowers	11
	HEAT EXCHANGERS & WATER HEATERS		
572	Niagara Blower Co.	Aero heat exchanger	128
505	Patterson-Kelley Co., Inc., The	Waste water heat reclaimer	9
556	Pick Mfg. Co.	Water heaters	112
	INSTRUMENTS & CONTROLS		
565	Liquidometer Corp., The	Tank gage	120
564	Powers Regulator Co., The	Water mixers	120
	LUBRICANTS & LUBRICATION EQUIPMENT		
528	Shell Oil Co.	Cylinder lubricant	41
536	Sinclair Refining Co.	Diesel lubricants	49
542	Standard Oil Co.	Diesel oils	55
550	Sun Oil Co.	Air compressor oils	103
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588	Lovejoy Flexible Coupling Co.	Flexible couplings	142
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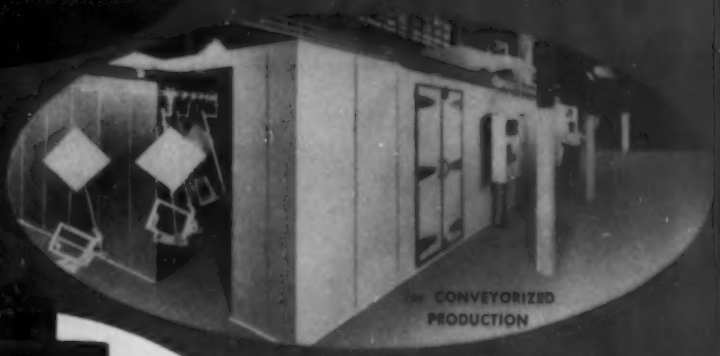
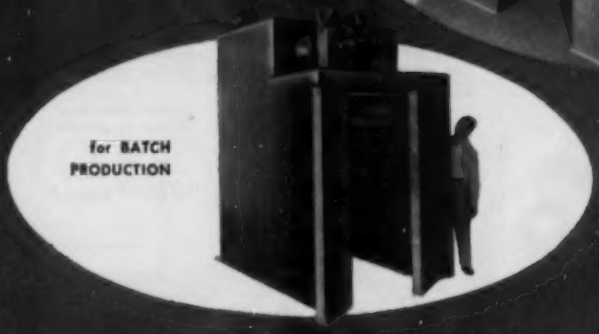
KIRK AND BLUM
INDUSTRIAL OVENS



for CONVEYORIZED PRODUCTION



for BATCH PRODUCTION

Specially designed to solve your problem . . . KIRK & BLUM Ovens meet all needs for drying, baking, dehydrating or other more specialized requirements.

Often Kirk & Blum Ovens up to freight car size are shipped completely assembled, tested and ready to operate. Then, they can be connected and in use in a few hours, saving time and expense. Illustrated are typical installations which show the wide range of KIRK & BLUM experience over more than 47 years.

If you have an oven application, discuss it with a KIRK & BLUM Engineer. There's no obligation. Write for free literature.

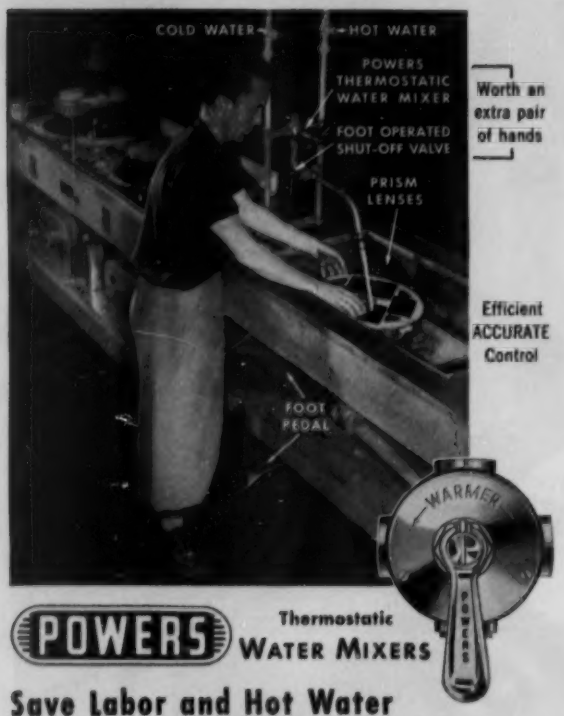
for TESTING or LABORATORY

THE KIRK & BLUM MFG. CO.,
3174 Forrer St., Cincinnati 9, Ohio

KIRK AND BLUM
INDUSTRIAL OVENS

Circle 563 on Reply Card for more data

POWERS Control Helps argus CAMERAS, Inc.
produce high quality precision lenses



Worth an extra pair of hands

Efficient ACCURATE Control

POWERS Thermostatic WATER MIXERS

Save Labor and Hot Water also Help Prevent Damage to Lenses

Photo above shows one of 75 washing operations in ARGUS CAMERAS, Inc. large modern lens polishing department. Here lenses are made for their popular line of cameras, projectors and optical instruments used in our nation's defense.

Combination of a Powers Type H Thermostatic Water mixer and a BRADLEY foot operated shut-off valve releases both of worker's hands for lens washing. Accurate control of water temperature prevents damage to lenses. Instant shut off of washing water by foot operated pedal prevents waste of hot water.

Double-Safety Feature of POWERS Water Mixer shown above: It *thermostatically* mixes hot and cold water and delivers the mixture at any temperature desired regardless of **pressure** or **temperature** changes in water supply lines. Failure of cold water instantly shuts off the delivery. Users often report accuracy of ± ½° F. Capacity 2 to 10 gpm @ 45 psi. *Write for Bulletin 365.*

Larger Capacity Water Mixers available up to 1200 gpm @ 45 psi. Write for Catalog WC. (b66)

THE POWERS REGULATOR CO., SKOKIE, ILL.
Offices in over 50 Cities, see your Phone Book • Established in 1891

Circle 564 on Reply Card for more data

readers' guide

—Starts on page 118

Circle key numbers on Reply Cards for more data

Key No.	Advertiser	Product	Page No.
	VALVES & REGULATORS		
594	Atlas Valve Co.	Regulating valves	146
547	Chapman Valve Mfg. Co., The	Gate valves	60
504	Darling Valve & Mfg. Co.	Gate valves	7
580	Darling Valve & Mfg. Co.	Pumcups	136
592	Henszey Co.	Flow meters	143
541	Leslie Co.	Control valves	54
520	Rockwell Co., W. S.	Butterfly valves	32
586	Skinner Co., M. B.	Valve & bibb reseater	141
549	Yarnall-Waring Co.	Blow-off valves	62
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573	Bird-Archer Co., The	Water treatment	129
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526	Elgin-Refinite, Div. of Elgin Softener Corp.	Water conditioning	39
589	Hungerford & Terry, Inc.	Water treatment	142
529	Infilco Inc.	Water treatment	42
508	National Aluminate Corp.	Water treatment	13
516	North American Mogul Products Co., The	Water treatment	27
521	Rohm & Haas Co.	Water treatment	33
	MISCELLANEOUS		
563	Kirk & Blum Mfg. Co., The	Industrial ovens	119

Circle 565 on Reply Card for more data

Points to look for when you select a Packaged Boiler:

1 Fiberglas insulation with metal jacket and metallic paint finish.

2 Lift lugs for convenient handling on job site.

3 Boiler shell made of flange quality steel. All joints electrically welded. High pressure shells X-rayed to insure flawless construction and long life.

4 Separator to assure dry steam supply (99%+).

5 Practical front-end construction provides open flow of combustion gases to stack. No refractories to maintain. Entire burner front hinged, providing easy access to fire tubes.

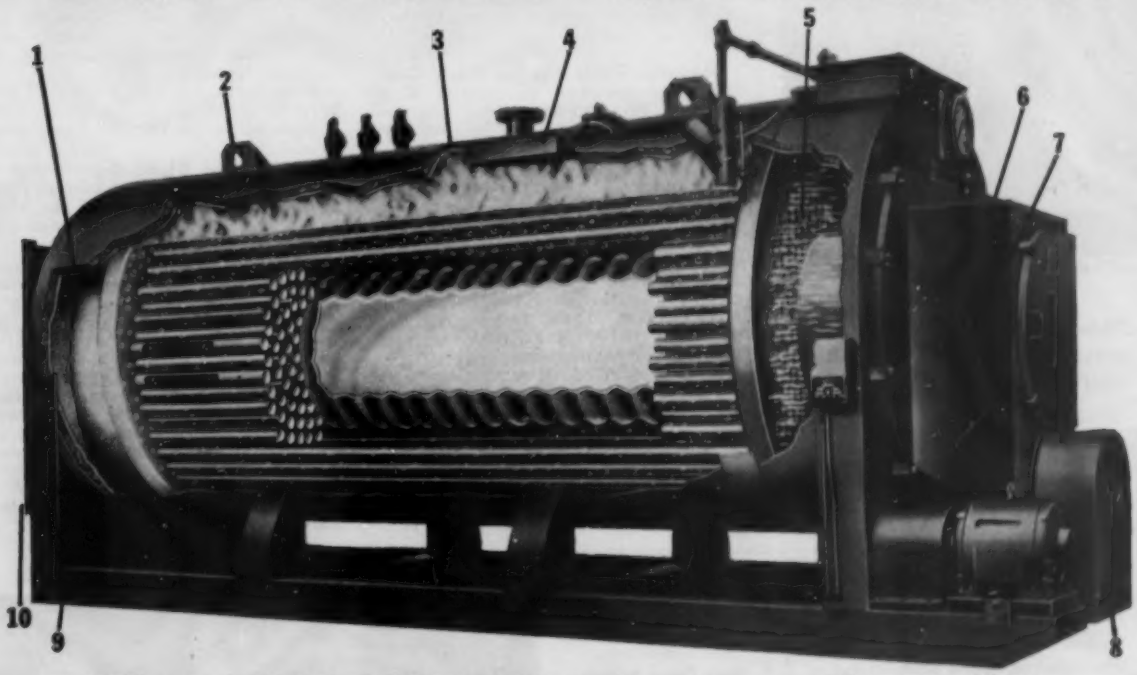
6 Burner and its vital parts—such as fuel nozzles, flame scanner and ignition assembly—fully enclosed in steel housing for safe operation.

7 Dual air-flow burner—for oil or gas fuels—precisely fitted to the boiler furnace. Burner specially designed to mix fuel and air for high combustion efficiency. Heat transferred directly to water surrounding the furnace.

8 Air for the burner passes through an inlet silencer to a forced draft fan. Air flow controlled by adjustable dampers.

9 Structural steel base distributes weight evenly on boiler room floor. No special foundation required.

10 Hinged rear door lined with insulating refractory. Door can be opened in a few minutes—affording access to furnace and all return tubes. No need to remove and replace refractory baffles or brick work. Note sturdy hinge construction which insures positive seating of door.



The CONTINENTAL Automatic Boiler

- Two-pass design—simple and practical. Range 20 to 500 hp.
- Factory-tested before shipment. Guaranteed 80% efficiency.
- Maximum radiant heat transfer from flame to water-cooled furnace walls.
- Even heat transfer—uniform flow of hot combustion gases through all return tubes.
- Free and rapid water circulation keeps all heating surfaces clean and improves transfer of heat to boiler water.
- High CO_2 and low stack temperature—guaranteed not to exceed 125°F. above saturated steam temperature at operating pressure.

CONTINENTAL BOILER DIVISION
BOILER ENGINEERING & SUPPLY COMPANY, INC.
1000 Manavon Street • Phoenixville, Pa.

40 YEARS OF BOILER MANUFACTURING EXPERIENCE

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

Circle 566 on Reply Card for more data

need information on

electrical equipment?

reach for your Plant Engineering File

"...a great time-saver"

These manufacturers' catalogs are instantly available in Section 2 of your Plant Engineering File:

Adams, Frank, Electric Co.
Allen-Bradley Company
Allis-Chalmers Manufacturing Co.
BullDog Electric Products Co.
General Electric Company
Master Electric Company
Mercoid Corporation
Penn Electrical Company
Wagner Electric Corporation
Westinghouse Electric Corp.

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street,
New York 18, N. Y.

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names make news

. . . personalities from industry and power

The Trane Co. announces the association of **Robert S. Knowles** with the Richmond, Va., sales office as a sales representative.

Power Fan Manufacturers' Association elects **C. Espy Reed,** Reed Unit-Fans, Inc. to head the group for 1954. Other officers are **John F. Snow,** Davidson Fan Co., 1st vice president; **E. C. Englert,** Hartzell Propeller Fan Co., 2nd vice president; and **G. W. McCormick, Jr.,** secretary-manager.

Wheeling Corrugating Co. — James A. Farrington, special assistant to the plant engineer at the Steubenville, Ohio Works, retired on April 1st, completing a career which began in 1903.

Two promotions in the sales department are the appointment of **J. A. Lane** to assistant to the vice president, and **A. F. Stewart** manager of market research and sales analysis division.

Johnston Pump Co. — Hugh Glen is elected president to succeed **Mrs. Thomas W. Simmons** who has resigned as president, but is still sole owner of the firm.

Refractory & Insulation Corp. — Thomas L. Morrissey and **Henry W. Clement** are elected to the board.

Graver Water Conditioning Co. — A. J. Soriente is promoted to project engineer in the cold process equipment section of the engineering department. **E. A. Strahlendorff** is appointed chief estimating engineer.

In the sales department **James J. Hanratty** is now district sales engineer for New York; **C. W. Miller** is Iowa representative; and **David M. Spillane** is Chicago district manager.

Westinghouse Electric Corp. — Vice president **William C. Rowland** is assigned responsibility for the Steam Div. Succeeding Rowland as manager of the Manufacturing and Repair Div. is **Chris H. Bartlett. Ray H. Timmons** becomes works manager of Steam Div.

Two new appointments at the Electronic Tube Div. are **Franklin P. Hinman,** named acting manager of manufacturing and **Harry F. Pully** named to the newly-created position of acting manager of the plant.

Key appointments to the staff of the new Air Conditioning Div. are: **William B. Cott,** sales manager; **John L. Ditzler** engineering manager; **Clifford M. Sayre,** manager of manufacturing; **Charles E. Smoyer, Jr.,** manager of accounting; **Harold L. Goehring,** industrial relations manager; and **John C. Feick, Jr.,** purchasing agent.

Beaumont Birch Co. has appointed the D. J. McAllister Boiler Works, 862 N. Spauling Ave., Chicago 51, Ill., representatives for the Chicago area with **Victor Gauger** responsible for sales supervision.

Ross Irwin Equipment Co., 713 Ambassador Bldg., St. Louis, is appointed representative in the St. Louis area.

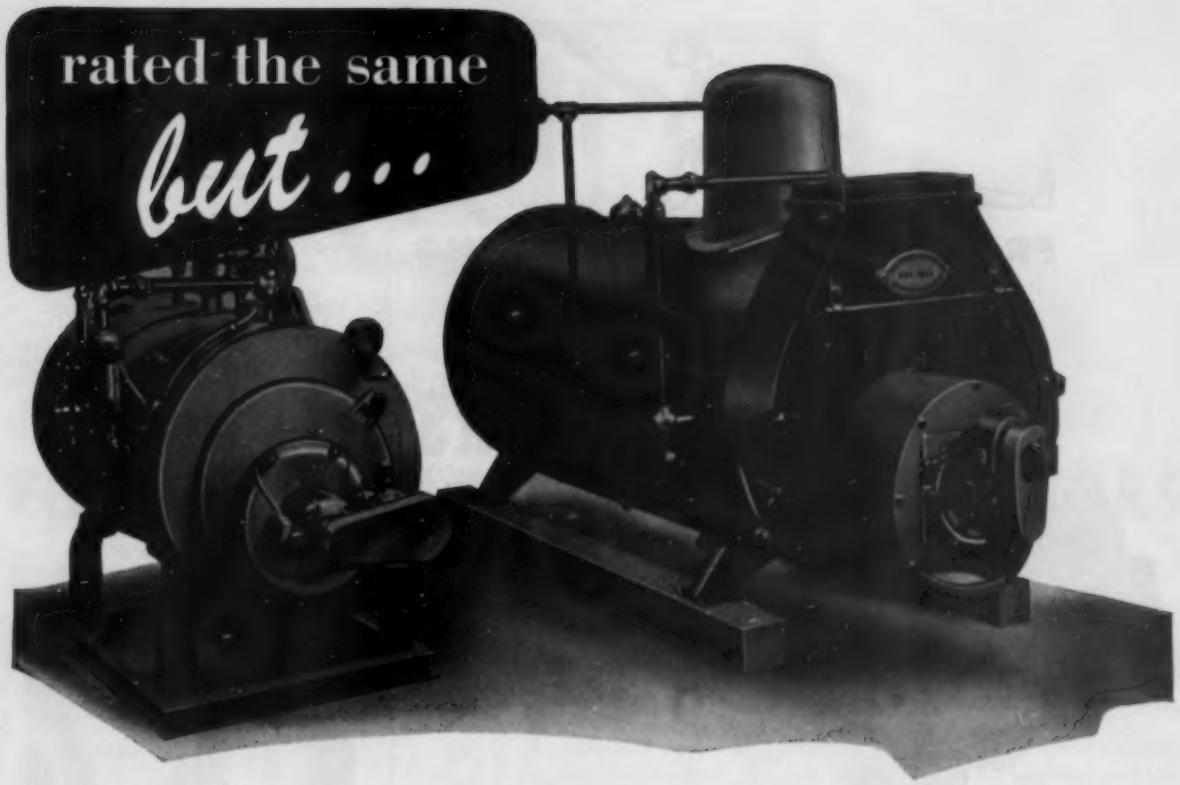
International Nickel Co.—Arthur A. Conrad, Jr., metallurgist, joins the Detroit Technical Section of the company's Development and Research Div.

Fairbanks, Morse & Co. announces the appointment of **Glenn A. Parker** as manager of the Kansas City, Missouri, branch house, succeeding **W. W. Guernsey** who recently retired after 38 years of service with the company.

General manager of Fairbanks, Morse de Mexico S. A., and Manufacturera Fairbanks, Morse S. A. with offices in Mexico City and Tlalnepantla will be **Mario A. Gasque.** He succeeds **Paul A. Suess** who has been transferred to the company's Los Angeles branch as manager. **Alfred M. McLaren** is transferred to St. Louis to

ELECTRIFICATION

More Power to America Award for 1953 presented by General Electric Co. for encouraging the electrification of industry goes to Philadelphia Electric Co. and Arizona Public Service Co. Left to right are: Harry Restofski, Edison Electric Institute; Douglas B. McGregor, A.P.S.C.; J. F. Gaskill, P.E.C.; and Karl Runkle, G. E.



only the bigger, stronger LEFFEL can deliver when you need extra steam

Look at these figures

	LEFFEL BOILER	A "PACKAGE-TYPE" BOILER
Rating	20 HP	20 HP
Length	9'	6' ±
Height	6'8"	4'6" ±
Heating Surface	181 sq. ft.	54 sq. ft. ±
Shipping Weight	6500 lbs.	2500 lbs. ±
ACTUAL MAXIMUM CAPACITY	40 HP 1380# per hr.	20 HP 690# per hr. ±

It will pay you — in the long run — to compare carefully and buy wisely.

The Leffel boiler is rated at 20 H.P.; so is the little "package-type" steam boiler. All similarity ends with that claimed rating.

The package boiler may deliver 20 H.P. — but no more. The Leffel boiler can be operated day after day at *50 percent above its rating;* in an emergency it can deliver up to 40 H.P. with safety.

Claims can't help you get steam from a boiler which is prone to break down under the strain of continuous operation — which just can't deliver beyond its rating.

There's no corner-cutting in the construction of a Leffel boiler. It's built to take it. Performance proves that Leffel's extra-rugged construction means greater dependability and longer life, plus the ability to carry a 100% overload in an emergency.

One look should tell you that the bigger, obviously stronger Leffel boiler will be a more reliable source for the steam you need. And you will find that despite their greater strength and greater capacity, Leffel boilers are competitively priced.

If you're looking for a completely dependable source for low-cost steam, trouble-free service and simple operation, you'll want to know more about Leffel boilers. They are built in a complete range of sizes from the smallest to the largest Scotch types, for oil, gas or coal firing. Bulletin 236 has all the details; send for your copy today.

FOUNDED IN 1862

THE JAMES LEFFEL & CO.

DEPT. C, SPRINGFIELD, OHIO, U. S. A.

MORE EFFICIENT STEAM GENERATION FOR 92 YEARS

Circle 568 on Reply Card for more data

FROM THE VERY BEGINNING

Paracoil FUEL OIL HEATERS

have been the No. 1 choice of the leading packaged type boiler manufacturers for their heavy oil-fired units.

This long-established preference stems from the many important design features that have made them the logical choice for this type of steam generator.

- Sturdiness of construction, coupled with lightness of weight
- High rate of heat transfer—from 2 to 3 times that of ordinary straight tube design
- Small space requirements, permitting easy installation within boiler base area

These outstanding qualities were quickly recognized by all pioneers of the packaged boiler industry, and their preference is still for PARACOIL.

MORE HEAVY OIL PACKAGE TYPE BOILERS IN OPERATION TODAY USE PARACOIL HEATERS THAN ALL OTHER MAKES COMBINED

see our catalog in INDUSTRIAL CONSTRUCTION FILE or write for copy

DAVIS ENGINEERING
CORPORATION

1064 E. Grand Street, Elizabeth, 4, New Jersey . 30 Rockefeller Plaza, New York 20, N. Y.

Circle 569 on Reply Card for more data

names

—Starts on page 122

take over the company's branch house operations in that area, succeeding **Cliff Schroeer** who passed away.

Preferred Utilities Mfg. Corp. — H. A. Pietsch Co., 894 Heckler Drive, Pittsburgh 20, Pa., are sales and engineering representatives for the "Preferred" line of unit steam generators in Western Pennsylvania, West Virginia and Eastern Ohio, under the direction of **Herman A. Pietsch.**

The Babcock & Wilcox Co. — **Edward A. Livingstone,** a vice president, is elected to the board of directors and placed in charge of the Tubular Products Div. **W. J. Thomas,** general manager of the division, is named a vice president. **Luke E. Sawyer,** formerly head of the division, becomes a consultant to the company.

Livingstone **Thal**

Link-Belt Company appoints **Donald E. Thal** as central general manager of its Pacific Div., with headquarters at the San Francisco plant, where he has been serving as sales manager.

Detroit Stoker Co. announces the new address for its Chicago District Office as 222 W. Adams St., Room 1415, Chicago 6, Ill.

American Society of Mechanical Engineers names **T. A. Marshall, Jr.** director of public relations.

The Permutit Co., with a newly completed 83,000 sq ft factory on the outskirts of Lancaster, Pa., announces the appointments of **J. Harrahill** as plant manager, and **F. K. Richardi** as assistant plant manager of Lancaster Div.

Superior Combustion Industries announces the appointment of **Frank F. Hohnholt** as manager of its Water-Tube Steam Generator Div.

Aluminum Company of America—**Edgar H. Dix, Jr.,** assistant director of research, Aluminum Company of America, has received the Frank Newman Speller Award of the **National Association of Corrosion Engineers.**

Sun Oil Co.—Contracts for the engineering and construction of two important new additions to Sun Oil Co. facilities at Marcus Hook, Pa., have been awarded to the Catalytic Construction Co.

TODD

GREATEST NAME IN FIRING PACKAGE STEAM GENERATORS

OIL, GAS OR COMBINATION BURNERS

CONTROL PANELS

PUMPING, HEATING AND STRAINING SETS

On every count *TODD products have more than merited the recognition accorded them by the manufacturers of package boilers in commercial sizes.*

1. *TODD is the Oldest Supplier of such Fuel-Burning Equipment.* Pioneers in the field, Todd began manufacturing units for package steam generators even before World War II.

2. *TODD Possesses an Unrivalled Breadth of Experience.* Not only has Todd been engaged in the manufacture of fuel-burning equipment for package generators *longer* than any other maker, but Todd has also supplied the right type of burner for every *different* type of boiler.

3. *The TODD Line of Burners is the Most Complete in the Industry.* Regardless of the specialized needs, Todd can furnish exactly the type of fuel-burning or fuel-handling equipment required. For Todd makes *not* one, but *all* types of package generator burners—for example, Rotary—Roto-Press—Register, with steam or mechanical atomizer.

4. *TODD Policy Calls for Continued Research and Development.* As soon as new combustion problems arise from technological advances in parallel fields, the Todd team begins work upon their solution. This has been, and will continue to be, standard Todd practice. As a consequence, Todd engineers of the Combustion Equipment Division stand ready to cooperate with your research, industrial and production engineers in supplying you with the most efficient and most economically-operating burners money can buy.

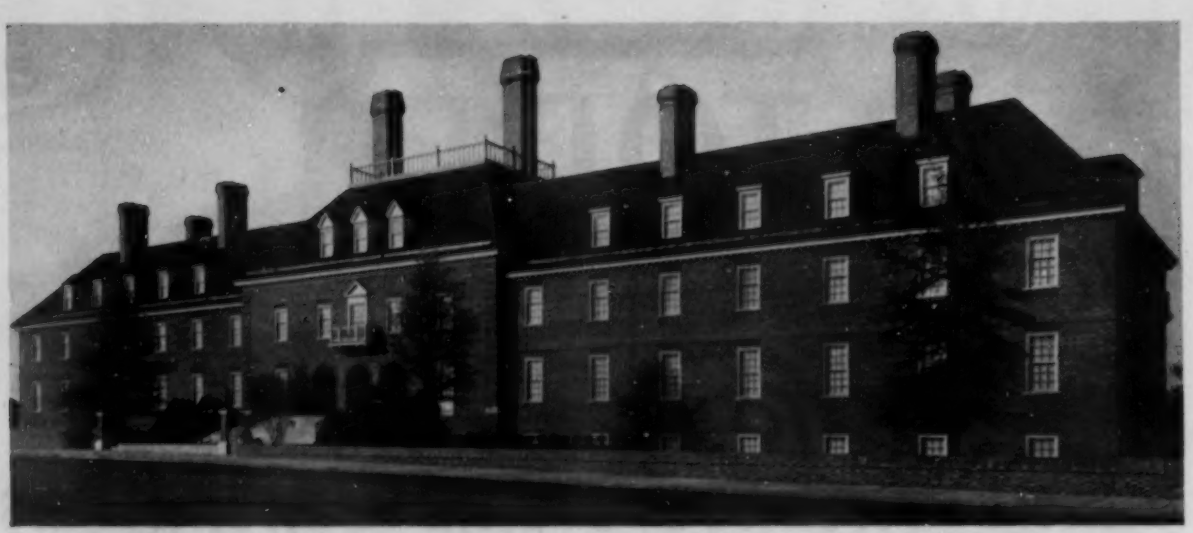
TODD Engineers are always available for consultation . . .
without obligation, of course. You are invited to call.

COMBUSTION EQUIPMENT DIVISION

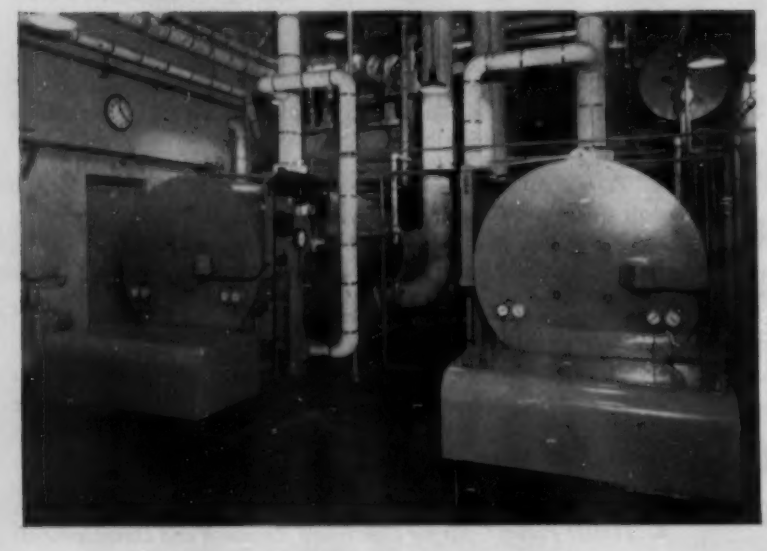
TODD SHIPYARDS CORPORATION

81-16 45th Ave., Elmhurst 73, N. Y.

Circle 570 on Reply Card for more data



In Colonial Virginia, attic boiler room provides perfect setting for Steam-Pak Generators



Two Model SPL-100-5 Steam-Pak Generators provide heating and hot water for "Colonial Williamsburg" headquarters of Home Beneficial Life Insurance Co., Inc., 3901 West Broad Street, Richmond, Va.

• • •

Boiler room is located in attic space directly under two tall chimneys in the center. Chimney center right is used for Steam-Pak Generators, center left to provide air shaft to boiler room. Steam-Paks are mounted on Korfund bases and room is sound insulated.

• • •

One Steam-Pak carries entire load including air conditioning, heating, and domestic hot water except in very cold weather when second unit operates. In summer, one unit is used to reheat the air for the air-conditioning system.

• • •

Building designed by Carneal & Johnson, Architects, Richmond, Va. Consulting engineer was Charles S. Leopold, 213 S. Broad St., Philadelphia, Pa. Heating Contractor—Wm. H. Singleton Co., Inc., Richmond, Steam-Pak Generators sold by Pelouze Sales Co., Hillcrest Bldg., Richmond.

Steam-Pak Generators are the modern power plants for today's buildings. Compact in size and fully automatic, they can be installed where required—anywhere from the basement to the attic. Steam-Pak users report amazing savings in fuel and maintenance costs over other types of equipment. Write today for complete Steam-Pak facts.

YORK-SHIPLEY, INC.
YORK 4, PA.

Please send me complete data on Steam-Pak Generators.

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Company _____

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City _____ State _____

SEND COUPON TODAY FOR STEAM-PAK FACTS!

Steam-Pak Generators are built in sizes from 15 h.p. upward, for high or low pressure, and for light or heavy oil or combination oil-gas.

YORK-SHIPLEY, INC., YORK, PA.

Manufacturers of York-Power F/C Industrial Fuel Burning Systems

Circle 571 on Reply Card for more data

bulletins

. . . for listing of the bulletins just received see page 36

AIR CLEANING & DUST COLLECTION

230—Dehydration

To meet the increased demand in engineering operations for small volumes of dry gases not warranting plant size installation, this company has developed the Hy-dryer, described in this seven-page booklet. Operation of the unit is explained by means of text and pictures. Tables give engineering data necessary for ordering. J. F. Pritchard & Co., Equipment Div.

231—Dust Collectors and Arrestors

Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

232—Tubular Dust Collectors

Six booklets, 3-PDC-1, 2 and 2-PDC-1 through 4, on mechanical dust collectors cover capacities and efficiencies, dimensions, construction and the decantation method. Latter method is used on installations where reinjection of large, unburned high carbon particles is required. Separation from flyash is accomplished in a single unit. Prat-Daniel Corp.

233—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

234—Precipitation Equipment

Engineers contemplating the installation of equipment for recovering dusts, fly ash, fumes, mists, fogs, or other similar suspensions in stack or process gases will find much valuable data in this 40 page booklet. Western Precipitation Corp.

334—Dust and Fume Removal

This 19-page bulletin, 610, pictures and describes the standard units that go to make up the Multi-Wash System for the removal of air-borne dust, fumes, vapors, and odors. Besides explaining the operation and advantages of each component of the system, the booklet includes many installation photographs. Bulletins are offered covering each type of equipment made by this company. Claude B. Schneible Co.

AIR CONDITIONING— HEATING & REFRIGERATION

235—Air Conditioner

Precision control of air temperature and moisture enable you to produce your product in any climate, at any season, according to six-page bulletin 122. The Type "A" air conditioner described, for drying or moistening of air, is shown in typical installation photographs. Niagara Blower Co.

335—Propeller Fans

Three new models are among the 13 types of fans shown in 40-page bulletin A-109. It also describes three types of roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all of the equipment plus valuable engineering data. Hartzell Propeller Fan Co.

BOILERS & STEAM

236—Vertical Unit Boiler

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

237—Feedwater Gas Analyzer

Described in four-page folder 148EP is an analyzer for measuring dissolved oxygen and hydrogen in feedwater. Advantages, ranges, and accuracy are discussed. Cambridge Instrument Co., Inc.

238—Spreader Stokers

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 lb steam per hr, steam or compressed air operated, are described. Detroit Stoker Co.

239—Boilers

Firebox boilers are discussed in bulletin 703. This four-page pamphlet describes the principle features and presents a detailed chart of dimensions and capacities. Boilers are available from 13 to 61 hp. Johnston Bros., Inc.

240—Boiler Controls

Specifications for the fully automatic, all electric metering type packaged control for shop assembled boilers are given in four-page folder 53-1068-230. Schematic drawing shows a typical packaged control system for a combination oil and gas fired boiler. The Hays Corp.

336—Liquid Level Gages

Remote reading liquid level gages to protect boilers, deaerating tanks, feed water heaters, and storage tanks are described in eight-page bulletin 176. A typical schematic drawing of a steam boiler application shows the gage in use. Drawings also illustrate wall and panel mounting. Jerguson Gage & Valve Co.

337—Pressure Equipment

One of the Country's oldest manufacturers of equipment and accessories for plants piping steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. Wright-Austin Co.

241—Boilers

Self-contained boilers for heating and processing are described in seven-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

242—Firing Equipment

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included. Petro Division.

243—Cyclonic Combustion

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your Questions Are Answered by Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

PRODUCT INDEX

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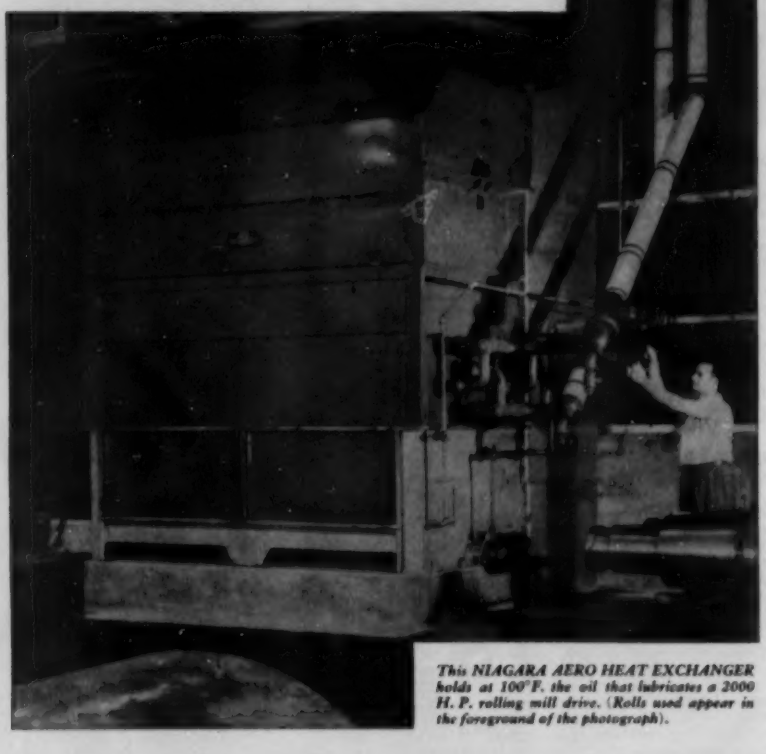
NOTE—Each bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pgs. 34/35 & 114/115.

YOU CAN KEEP ACCURATE CONTROL OF LUBE OIL TEMPERATURE



This NIAGARA AERO HEAT EXCHANGER holds at 100°F. the oil that lubricates a 2000 H. P. rolling mill drive. (Rolls used appear in the foreground of the photograph).

The Niagara Aero Heat Exchanger uses atmospheric air to cool liquids and gases by evaporative cooling, removing the heat at the rate of input, controlling temperatures precisely. You save 95% of the cost of cooling water. You get great saving in piping, pumping and power, quickly getting back the cost of the installation.

You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemicals for processes and coolants for mechanical and electrical equipment. You can cool welding machines, hydraulic and extrusion presses, plastic molds, furnaces, controlled atmospheres, quench baths, obtaining better results with precise temperature. You obtain closed system cooling, free from dirt or scale.

For further information, write for Bulletin No. 120

NIAGARA BLOWER COMPANY

Dept. IP, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of United States and Canada

Circle 572 on Reply Card for more data

bulletins

— Starts on page 127

244—Automatic Burner

Newly designed automatic burner, model PK-54, for oil, gas, and oil or gas, is described in four-page folder 430. Safety features are listed and the unit's integrated design is explained. For capacities to 42,000 lb steam per hour, the burner is described as a complete, automatic combustion unit including burner, blower, and controls. Peabody Engineering Corp.

245—Boiler Baffles

"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

246—Boiler Replacement

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. Superior Combustion Industries, Inc.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 34/35 & 114/115. Your request will be handled promptly.

247—Packaged Steam Generators

Basic construction and design features of plant assembled steam generators, with or without superheat, are presented in illustrated 20-page booklet P6-51-2. Includes tables of engineering specifications for units from 10,000 to 30,000 lb steam per hr and design pressures from 250 to 825 psi. Also includes section on control and instrumentation. Foster Wheeler Corp.

248—General Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in four-page folder. Steam generators, heat transfer equipment, pressure vessels, valves, and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

249—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 34 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

338—Boilers & Stokers

Over 88 years experience are embodied in the design and construction of Scotch Marine type portable boilers says 28-page catalog. Advantages of this internally-fired, return-tubular boiler are thoroughly discussed. Photographs and cross-sections illustrate various models ranging

in capacities from 6 hp up to 25 hp. Details and features of underfeed stokers designed especially for this type boiler are contained in separate section. The James Leffel & Co.

250—Steam Generators

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

251—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. A selector chart is included. L. J. Wing Mfg. Co.

252—Packaged Steam Generators

Construction of packaged steam generators is described in eight-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

253—Off-Center Firing

Design features of a compact, automatic package boiler are discussed in four-page folder EC-1152. The theory of off-center firing, used with these units, is discussed. Specifications for units through 250 hp are tabulated. Dutton Boiler Div., Hapman-Dutton Co.

254—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

255—Oil & Gas Burner

Described in 16-page bulletin ID53-162 is a factory-coordinated, industrial fuel burning system. Built around an industrial burner for oil or gas firing, the system includes proper controls mounted in panels and wired to terminal strips for easy connection, factory engineered windbox and refractory ring, fuel oil heaters, and trim. York-Shipley, Inc.

256—Package Boilers

Automatic boilers for light oil, heavy oil, gas, or combination gas or oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. A cross-section shows components of system. Orr & Sembower, Inc.

257—Package Boilers

Two-drum, bent tube package boilers for steam, and high pressure, high temperature hot water are discussed in a four-page folder. Ratings, data, and dimensions are given in table form. Springfield Boiler Co., Div. of John W. Hobbs Corp.

258—Water Tube Boilers

According to this eight-page publication, standardization of design has made possible the manufacture of a modern, compact, and efficient water tube boiler of two-drum design. Designs are available for oil burning or stoker feed as well as gas. Bulletin 49-1 "Two-Drum Type S Steam Generators." The Wickes Boiler Co.

259—Combustion Processes

Too much or too little air can have costly effects in combustion processes. Bulletin "Oxygen-Index of Combustion Processes" points out that by using oxygen

PORTFOLIO OF BIRD-ARCHER ENGINEERING SERVICES FOR WATER TREATMENT

For experienced counsel and personal attention to water or steam problems at your plant, it will pay you to call on Bird-Archer's qualified engineers. Highest quality chemicals and over sixty years experience assure maximum results with Bird-Archer's Complete Water Treatment Service.

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Specification and furnishing of additional equipment when necessary, including complete analysis of savings and benefits made possible.

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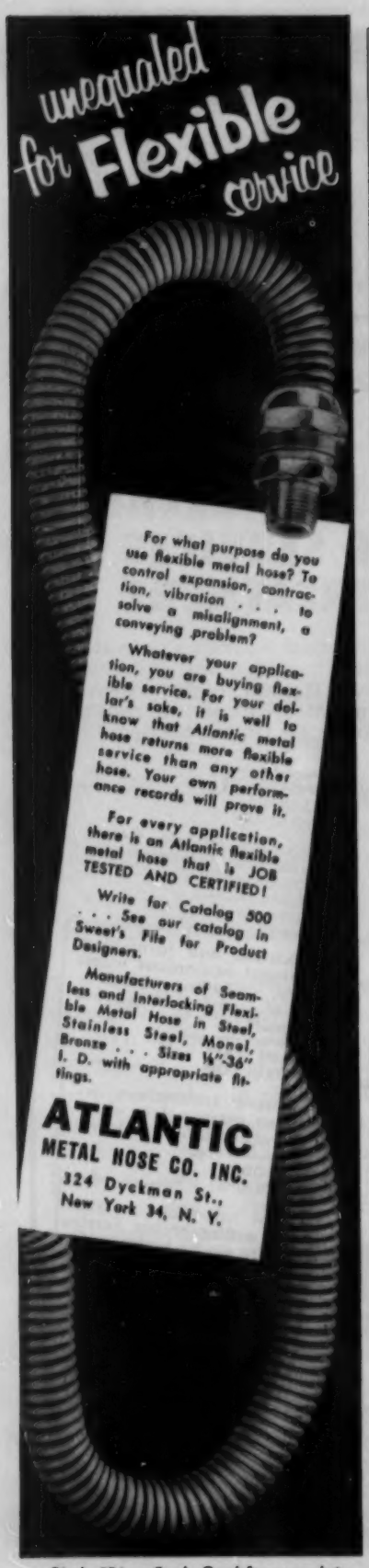
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Whatever your application, you are buying flexible service. For your dollar's sake, it is well to know that Atlantic metal hose returns more flexible service than any other hose. Your own performance records will prove it.
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324 Dyckman St.,
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bulletins

— Starts on page 127

itself as the criterion to proper combustion, greater over-all efficiency, and more economy can be realized. Sample point location and equipment requirements are discussed. Arnold O. Beckman, Inc.

260—Soot Blowers

Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests the various uses for boilers, superheaters, reheaters, economizers, heat exchangers, and oil stills. The blower described is available for three pressure ranges up to and including 1500 psi. Diamond Power Speciality Corp.

261—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ¾ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The publication describes various types of drills available. The Airetool Manufacturing Co.

262—Water Gages and Columns

How the Bi-Color water gage operates to show actual water level without transmission by mechanical, electrical, or hydrostatic means is explained in 23-page bulletin 1051. The many types of gages and their installation are pictured. High-low water alarms, soot blowers, and the "Utiliscope" wired television unit are also described. Diamond Power Specialty Corp.

263—Spreader Stokers

Spreader stokers said to be adaptable to all types and makes of modern steam boilers and generators, from 5000 to 75,000 lb per hr steam output capacity, are described in 14-page brochure 800. Various installations using Roto-Stoker Type CC stokers of these capacities are highlighted by means of cross-sectional drawings. Detroit Stoker Co.

264—Water Tube Boilers

Packaged water tube Type H boilers, shop assembled, are described in four-page folder 3M. Capacities, dimensions, and weights are listed in tables. Drawings show various views and elevations. The Bigelow Co.

265—Flue Dampers

Four booklets, 1-HEA-1,2,3,4 on curtain type dampers for flue gas control explain what the damper is and does, construction, dimensions, installations, and give case histories. Booklet shows drawings and photographs of variety of damper types. Heacon, Inc., The Thermix Corp., Project Engineers.

266—Unit Steam Generator

Design features of unit steam generators are discussed in 28-page booklet 2000. Illustrations supplement discussions. Data and dimensions of the units are listed. Capacities are listed from 600 to 20,700 lb steam per hr. Preferred Utilities Mfg. Corp.

339—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

270—Burners

The Roto-Press burner described in seven-page booklet 9101 is designed to meet the demand for maximum steam, automatic firing, minumum floor space, and elimination of high stacks. How to convert your standard rotary burner to a Roto-Press is explained. Combustion Equipment Div., Todd Shipyards Corp.

BUILDING MATERIALS & MAINTENANCE

267—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

268—Thread Compound

A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

269—Flooring

"Hand Book of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with other materials for repairing floors. Flexrock Company.

COMPRESSORS & BLOWERS

271—Compressors

Horizontal heavy duty air and gas compressors, Type T, are described in 15-page bulletin 728-8. Cross sections of crankshaft, inlet valve unloading system, compressor cylinder and valves, and the complete compressor add to the value of the booklet. Also included are brief descriptions of other arrangements. Chicago Pneumatic Tool Co.

CORROSION CONTROL

272—Rubber Linings

Application of rubber lining to prevent corrosion of tanks, pipes and valves is discussed and illustrated in 4-page folder. In addition, a 2-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Manufacturing Co.

ELECTRICAL EQUIPMENT

273—Dry Type Transformers

How to use dry type transformers profitably in your plant is explained in folder DT 193 which also includes wiring diagrams. Acme Electric Corp.

274—Metal Clad Switchgear

The HV line of metal clad switchgear is described in bulletin 7004B. Advanced engineering, refined design, and quality construction are included in this line according to the bulletin. I-T-E Circuit Breaker Co.

275—Outdoor Service Equipment

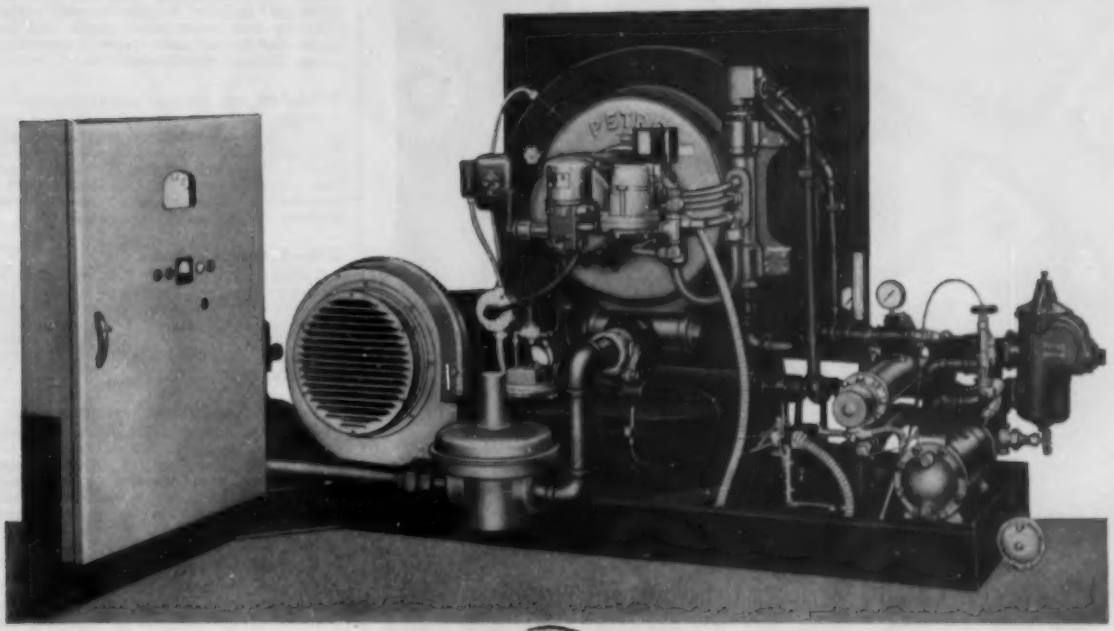
Designed to make easier the selection of outdoor service equipment, 12-page bulletin 2016 combines descriptive data on all available standard equipment—service entrance, receptacle type, dual control, three-phase units. Typical assemblies of circuit breakers and the various enclosures are listed for each type of equipment. Heinemann Electric Co.

276—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains

Petro

COMPLETE PACKAGED UNIT OIL, GAS, OR OIL-GAS COMBINATION BURNERS



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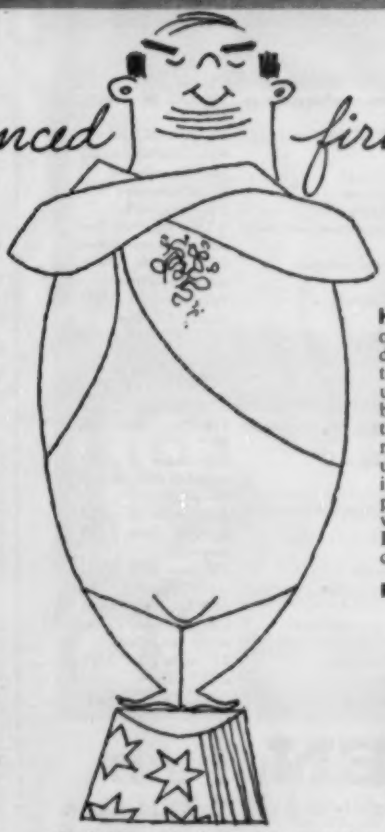

FOR OIL...

Burns any weight oil with complete dependability. Consists of heavy duty Petro horizontal rotary oil burner with steel windbox, refractory tile burner throat, secondary air volume control, motor-driven forced draft fan, and electrical control panel, all mounted on a rugged structural steel base, factory-wired and tested.

FOR GAS...

High combustion efficiency is obtained from all types of fuel gas with this ring-type forced draft burner. Fully modulating automatic controls supply fuel and air in exact proportions required to meet load demands, with excellent fuel economy. Combustion constantly monitored by electronic controls.

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Two complete burners—one for oil, one for gas—function independently. Fuels can be switched in a matter of seconds without loss of steam pressure, water temperature, or interruption of production. Gives alternate stand-by fuel and permits taking advantage of fuel price fluctuations. Write Petro, 3026 W. 106th Street, Cleveland 11, Ohio. In Canada: 2231 Bloor St. West, Toronto, Ontario.

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HERE THEY ARE—all the essential components of a modern firing system . . . burner, forced draft fan, air volume control, and enclosed electrical control panel in *one* complete packaged unit. It provides a sure way to modernize any boiler room for dependable, economical operation. Engineered to fit specific boiler and fuel requirements, it is installed as an integral working unit. Fully modulating controls follow variations in load demands. Forced draft system gives peak performance from the moment the burner starts, without dependance on high stack for draft. Exceptionally quiet operation. Write for specification sheets and full details.

Residential Oil and Gas Burners, Oil and Gas Furnaces and Boilers, Industrial and Commercial Oil, Gas and Oil-Gas combination Burners

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TUBELESS MAGNETIC AMPLIFIER DC SUPPLIES

for Automotive and Aircraft Industries

Sorensen Nobatrons Model MA6/15 and Model MA2850 are tubeless — using magnetic amplifier principles. They have plenty of current capacity — 100 amps at 6 volts or 75 amps at 12 volts in the MA6/15 and 50 amps at 28 volts in the MA2850. Please see the specs below.

The MA6/15 is designed primarily as an automotive production test instrument for use in checking window motors, heaters, clocks, radios, headlight dimmers, ignition systems, air conditioners, cigarette lighters. The MA2850 can be used for testing aircraft heaters, pitch changers, inverters, radar, fire control systems, etc. Built around tubeless circuits, both models are carefully engineered and built to give you years of trouble-free, dependable service. Write for information now!

SPECIFICATIONS

Model MA2850

Input voltage range	190-230, 3ϕ, 4 wire, 50~ .
Output	28 volts DC, adjustable between 23 and 36 volts.
Current	0 - 50 amperes
Ripple	3% max RMS
Regulation accuracy	±1% against line and load combined
Time constant	0.5 seconds under worst conditions
Dimensions	15½" wide x 25¾" high x 13" deep

Meters are standard.
Units are self contained.

Model MA6/15

Input voltage range	210-250 VAC, 1ϕ, 60~ .
Output	Adjustable 6 - 7.7 volts DC from 0-100 amperes Adjustable 12 - 15.4 volts DC from 0-75 amperes
Ripple	1% max RMS
Regulation accuracy	±1% against line and load combined
Time constant	0.2 seconds under worst conditions
Dimensions	21" wide x 36" high x 15" deep

Meters are standard. Cabinets optional

SORENSEN

SORENSEN AND COMPANY, 375 Fairfield Ave., Stamford, Conn.

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bulletins

— Starts on page 127

the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

277—Fuses

Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCB. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Bussmann Manufacturing Co.

278—Renewable Fuses

Sixteen-page bulletin S-40 describes the Economy De-Lay renewable fuses which are said to give safe and dependable time-delay on overloads. For every requirement, these fuses have inexpensive links which are easily replaced. Economy Fuse & Manufacturing Co.

279—Communication Systems

This data kit describes low-cost communication networks which make it possible to talk from control points to plant and between plant sites. Ease of installation is described along with the many possible arrangements for specific needs. Farmers Engineering and Mfg. Co.

340—Flexible Conduit

Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. American Metal Hose Branch, American Brass Co.

ELECTRIC UTILIZATION

280—D-C Power Sources

D-c power sources and supplies are described in eight-page booklet B-1049. Mechanical and electrical specifications are given for the Nobratron. Sorensen and Company, Inc.

281—Motors

Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

341—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed U. S. Electrical Motors, Inc.

HEAT EXCHANGERS & WATER HEATERS

282—Temperature Control

A simple method of controlling the temperature of liquid or gas is explained in four-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Niagara Blower Co.

283—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

284—Water Heaters

A streamlined system of heating water and process liquids quickly and at low cost is explained in this bulletin. The Instant Heater described eliminates the need for reducers. Cross-sectional drawings explain how the unit operates. Johnson Corp.

285—Instantaneous Water Heater

Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heaters as compared to the indirect method heater are discussed and illustrated. Pick Manufacturing Co.

286—Cooling Towers

Quick reference list of available literature on line of cooling towers and auxiliary equipment is contained in 4-page folder 1.19.002A. Types of cooling towers include mechanical draft, package type and atmospheric. Auxiliary equipment includes fans, fan drives and throats, louvers, and spray nozzles. Gas and air treating and heat exchanger equipment also are listed. J. F. Pritchard & Co.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 34/35 & 114/115. Your requests will be handled promptly.

287—Heaters

Horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, as well as the low-flow design are each cataloged as to weights, dimensions, construction details, and capacities—with conversion tables, in 48-page catalog 18. The Patterson-Kelley Co., Inc.

288—Water Heaters

Steam injection water heaters with the pressurizer piston for safe, quiet, automatic control are described in four-page pamphlet WH12A. How the unit saves space, time, fuel, installation, and maintenance costs is explained. Specifications for the seven standard sizes—for both direct and accumulator application—are given in tables. Pick Manufacturing Co.

289—Deaerating Heater

Bulletin WC-112, four-pages, describes a packaged deaerating heater, spray type, for the smaller steam generating plants. Vertical two-minute and horizontal ten-minute storage units are shown in cross section. Graver Water Conditioning Co.

290—Heat Exchanger

Widespread application of the Paracoil boiler water sample cooler No. 75 gives timely importance to pamphlet 110. In addition to the design specifications, a set of charts are included to determine cooling water flow rate for various sample temperatures. Additional features include typical piping hookups and detailed instructions on the installation and operation of the cooler. Davis Engineering Corp.

342—Unit Heaters

Catalog CUH 846-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit

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Interchangeable Atomizers

SAVE Three Ways

Gun Type Gas-Oil Burning Unit

These units offer money-saving flexibility in three important ways:

1. They can be used with oil, gas—or both.
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Ask for 28-page Bulletin OB-53 giving complete details of these and other fuel-burning units.

Enco Wide Range Mechanical Atomizer Gun

Enco Standard Range Mechanical Atomizer Gun

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Airetool small tube cleaners are designed to make it easier to thoroughly remove hard or soft foreign deposits of any type from condensers, heat exchangers, or other small diameter tubular equipment; quickly and with maximum safety to inside tube surfaces.

Used with either flexible drive or a universal joint, and powered by husky air-driven Airetool motors, these small cleaner heads quickly remove foreign deposits from straight or bent tubes of ⅝" to 2" I.D.

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Every type of heat exchanger and condenser tube, even those completely plugged, can be quickly cleaned by powerful Airetool outside mounted air-driven cleaners. Geared or direct-drive — positive handle control valve; drill is cooled by positive flushing system . . . sound deadening muffler.

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There's An Airetool Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

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bulletins

— *Starts on page 127*

heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." D. J. Murray Manufacturing Co.

INSTRUMENTS & CONTROLS

291—Instrumentation

Illustrated eight-page booklet R-8, "Results," presents the case history of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is fully described. The Hays Corp.

292—Flow Meters

With an alarm control, the flow meters described in this bulletin have only three moving parts. How it operates to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

293—Temperature Regulators

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

294—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces and also for sewage disposal plants. The Hays Corp.

LUBRICATION

295—Lubricating Oil

Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

343—Lubricator

Automatic force feed lubricator Model "94" described in 11-page booklet 94-C will pump against any steam or air pressure up to 1500 lb and will handle any grade of oil, from the lightest mineral to the heaviest cylinder stock. Manzel Div. of Frontier Industries.

METALS & WELDING

296—Steel Weldments

New close-tolerance machinery illustrated in this four-page folder makes it possible for this company to produce single components or complete assemblies to your plant's specification. Examples of equipment designed and engineered by this company are also given along with suggestions as to cast parts that can be replaced by fabricated steel weldments. The Foster Co.

PIPING, VALVES, & SPECIALTIES

297—Flexible Metal Hose

For what purpose do you use flexible metal hose? Whatever your application, you will find valuable information about job tested and certified hose in catalog 500. Included are data on steel, stainless

BETTER PRODUCTS AT LOWER COSTS - *by fabrication*

Photo above is all-steel punch press frame. Tho a third lighter than expensive castings it replaced, greater strength and rigidity of welded construction enable punch press to operate 50% faster.

Besides basic saving of material, plus values are reduced freight and handling costs, easier machining qualities. And future design changes can be made at nominal cost.

Because steel can be formed or cut into almost any size, shape or thickness, doubtless some of your own castings can be replaced by fabricated steel, at really worth-while savings.

Send us a print or a sketch of your product. Or if you wish our engineer will call on you. No obligation in either case.

THE FOSTER COMPANY, Saint Joseph, Mich.

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Wanta pump something at lower cost?

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Air	Dye Solutions	Latex	Salt Water
Alcohol	Edible Oils	Mash	Shortening
Ammonia	Ethane	Methane	Sludge
Beer	Fish Oils	Milk	Soap
Benzol	Formaldehyde	Molasses	Sodium Chloride Solution
Boiler Feed Water	Fresh Water	Naptha	Sodium Silicate
Brewer's Mash	Gas, Manufactured	Nitric Acid	Sodium Sulfate Solution
Butter	Gas, Natural	Nitrogen	Starch
Butane	Gasoline	Oil, Crude	Sulphuric Acid
Cane Syrup	Glucose	Oil, Refined	Sump Water
Calcium Carbonate Slurry	Glue	Oxygen	Sweet Water
Calcium Sulfate Slurry	Glycerine	Paint	Tomato Juice
Casein Solutions	Glycols	Potassium Hydroxide	Varnish
Cement Slurry	Hydrochloric Acid	Propane	Vinegar
Chocolate	Hydrofluoric Acid	Raw Boiler Feed Water	Viscose
CO_2 Gas	Ink	River Water—Dredging Operations	Water (various)
Crude Oil	Jam	Rosin	Wax
Dairy Products	Jelly		Whey
	Ketchup		
	Lacquer		

THIS list of fluids will give you a rough idea of the diversity of pumping jobs in which Darcova Pumcups are responsible for really *big* savings.

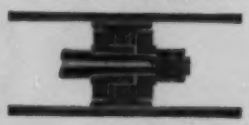
It boils down to the fact that Pumcups all but eliminate fluid slippage *throughout* their life span . . . and they *last many times as long as other packings.* Think of the down-time avoided, the production gains due to prolonged high efficiency, and the time-and-money-saving reduction in maintenance!

Years of application research have gone into the development of Pumcups. Made today in standard as well as many special compositions and textures for a wide range of temperature and pressure conditions, they offer you superior cost-cutting service in virtually *any* pumping job, simple or tough! And they're available in diameters from 1 to 20 inches.

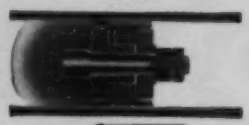
SEND FOR FREE BULLETIN

Why not weigh *all* the facts? Bulletin 4401 covers Darcova Pumcups for reciprocating pumps; Bulletin 4502 on Pumcups for air or hydraulic mechanisms. Write for yours today.

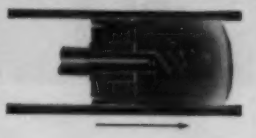
DIAGRAM OF DARCOVA PUMCUP ACTION (greatly exaggerated)



NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



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WILLIAMSPORT 9, PA.

DARCOVA — THE ORIGINAL COMPOSITION CUP

PUMCUPS

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bulletins

— Starts on page 127

steel, monel, and bronze hose in sizes 1/8 to 36 in. ID. Atlantic Metal Hose Co.

298—Couplings

Flexible couplings which never require lubrication are shown in 19-page bulletin 1000. Valuable engineering data for each type of coupling are given in table form along with drawings and application recommendations. Two more tables give conversion data for varying or pulsating load and for horsepower to torque. Lovejoy Flexible Coupling Co.

299—Float Traps

If you are planning to install low, medium, or high pressure float or float and thermostatic traps, you will need this illustrated catalog sheet. According to the data sheet, once these valves are installed, there is no necessity for the breaking of any pipe connection for servicing. Hoffman Specialty Manufacturing Corp.

301—Trapping Practice

Engineers concerned with steam traps should find 48-page catalog *J* a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

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Circle "key" numbers on Reply Card between pgs. 34/35 & 114/115. Your requests will be handled promptly.

344—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications. Davis Regulator Co.

345—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating expansion joint application and principles. Flexonics Corp.

302—Valves

The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Company.

303—Regulating Valves

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in four-page folder 709. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

304—Reducing Valves

Four-page folder 511-A lists actual small flow reducing valve capacities based on test data. Cross-sectional drawings show construction of the bronze and steel valves. Leslie Co.

305—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

306—Valves

Catalog 10 describes List 900 and 990 valves. The 900 is for a pressure range of 2000 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress with extra-strong stem and wedge-gate connection. Chapman Valve Manufacturing Co.

307—Rubber Lined Valves

This bulletin on rubber lined gate and check valves uses cross-sectional drawings to describe operation and construction. The fully revolving double disc, parallel seat principle is explained along with other advantages. Darling Valve & Manufacturing Co.

Torque Wrenches

Both inch-pound and foot-pound torquers are described in this complete 68-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept. IP, 12762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

308—Cast Steel Valves

Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

309—Pipe Hangers

This hanger catalog describes the complete line of adjustable pipe hangers and supports made by this company. Specifications, drawings and engineering data are included. Grinnell Company, Inc.

310—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

346—Steam Traps

Steam traps which vent air from steam units eight times faster than ordinary inverted bucket traps are described in four-page folder 1153. Complete buying information on these Super-Silvertop Heat-Kwik traps includes condensate capacities, sizes, weights, and prices. A short description of other products manufactured by the Steam Specialties Div. of this company is also given. V. D. Anderson Co.

347—Prefabricated Conduit System

Introduced in four-page folder 2310 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The literature explains how the system is installed and stresses simplicity of making joint connections. The Ric-wiL Co.

348—Steam Traps

Catalog 68G, 31 pages, describes and illustrates steam traps, strainers, regulating and reducing valves, separators, and vacuum and lifting traps. Included are

When should a circuit breaker ... be a circuit maker?

Interruption of short circuits and overloads is but part of a circuit breaker's job.

Equally important is the task of keeping power flowing through the line . . . safely . . . without needless stoppages.

Here's how Heinemann Circuit Breakers serve better in *both* functions. When current in the line reaches or exceeds ten times rating, the Heinemann Circuit Breaker opens the circuit instantly . . . faster than any comparable device available today. On lesser overloads, it responds with precise, proportioned time delay, allowing for normal in-rush and temporary, harmless overcurrents . . . thus preventing unnecessary service stoppages.

The hydraulic-magnetic operating principle further qualifies the Heinemann Circuit Breaker in its role as a better circuit *maker*. Because tripping points and current capacity remain constant regardless of ambient temperature, this principle permits safe use of full current capacity—summer and winter, in hot or cold locations—without de-rating or any form of temperature compensation. And, since no thermal elements are employed, nuisance interruptions due to ambient heat are eliminated.

Heinemann Circuit Breakers offer other advantages, too, in both convenience and economy. No reset is required. After a fault is cleared, service is restored simply by returning the handle to the ON position. And, because Heinemann Circuit Breakers have the lowest wattage loss, power is saved continuously throughout all the years of service.

INFORMATIVE LITERATURE AVAILABLE: For the straight facts, send for your copy of "What You Should Know About Circuit Breakers." Just ask for Manual 101.

HEINEMANN ELECTRIC COMPANY
140 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

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Easily...Economically with SUBALOX

SUBALOX is a complete paint system, so easy and economical to use that a single coat gives an excellent and lasting job. Can be applied by customary methods, but for most satisfactory application we recommend floor brooms.

SUBALOX is based on a heavy collodial lead pigment which gives excellent rust protection and limits spattering when applied to wire mesh.

SUBALOX is available in a variety of colors—the most popular being the metallics used to simulate the appearance of galvanizing. Old fences can be given a "new look" which can be easily maintained with a minimum of time, labor and material cost.

Detailed instructions are contained in "SIMPLIFIED FENCE PAINTING"—yours for the asking.

SUBOX Inc.

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bulletins

—Starts on page 127

applications, dimensions, and a handy steam properties table. Strong, Carlisle & Hammond Company.

POWER TRANSMISSIONS—MECHANICAL

311—V-Belts

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

312—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 16-page bulletin GBI, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives and couplings. Dynamatic Corp.

313—Belt Conveyor Design

Engineering data required to design a belt conveyor for any application are presented in 86-page catalog 852. The booklet, published to serve as a handbook on conveyor design, states that many problems can be answered by using a standardized unit. The Jeffrey Mfg. Co.

349—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163W. Uses and advantages of Thor belting are listed. Goodyear Tire & Rubber Co.

PUMPS

314—General Catalog

Equipment for buildings and institutions is the subject of 20-page bulletin WP-1099-B27M. Condensed information is provided on such equipment as air conditioning and refrigeration products; oil, gas and dual fuel engines; deaerators and de-aerating heaters. Worthington Corp.

315—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacitors to 1,000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. DeLaval Steam Turbine Co.

316—Rotary Gear Pumps

"How to Solve Pumping Problems," is the title of 36-page booklet 3060. In addition to presenting typical problems and their solutions, various types of rotary gear pumps are described. The major portion of the book is intended to serve as a data handbook. Nomographs of friction loss in pipe, resistance of valves and fittings, and viscosity of oils are included. Geo. D. Roper Corp.

317—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds,

are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. How these units decrease maintenance and lower operating costs is described. Darling Valve & Mfg. Co.

350—Proportioning Pump

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52R. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Hills-McCanna Co.

351—Non-Clogging Pumps

Type U non-clogging pumps designed for handling liquids carrying large amounts of solids and foreign materials are described in 11-page bulletin 730-C. The specific uses of each type pump are given along with tables to help in selection. Cross-sectional drawings are used to present special features of different types. Weinman Pump Manufacturing Co.

352—Vertical Pumps

"Vertical Pumps for Volatile Fluids," six-page folder 1026, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves also are included. Johnston Pump Co.

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353—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

354—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

355—Chemical Feeders

Install Series 50-T chemical feeder on your boiler feed-water pumps and you can forget troubles due to guesswork, inaccuracy or forgetfulness according to four-page folder 5M. Units for every requirement are pictured. Flow diagrams explain operation and advantages. Manzel Div. of Frontier Industries.

356—Pump Package Systems

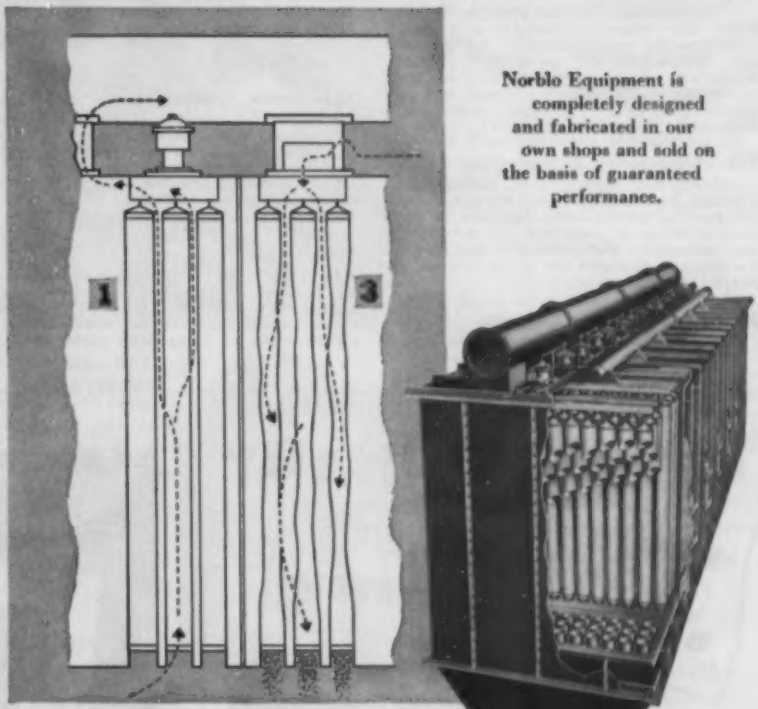
This catalog describes pump package systems including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gal complete with all accessories. The Manajust Stroke adjustment for varying capacity when pump is not operating, and the Autajust for precise control of flow while pump is running are explained. Orchem Pump Div.

357—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Co., Div. of New York Air Brake Co.

Norblo

gives you 24 hour-a-day DUST COLLECTION at full rated capacity



Norblo Equipment is completely designed and fabricated in our own shops and sold on the basis of guaranteed performance.

Double-action bag cleaning ... Constant suction drop

Norblo Automatic Bag Type Dust Collectors have proved the soundness of these operating principles for over 25 years:

1. Basic unit compartment houses 78 cylindrical bags, fully distended by upward inside air flow.

2. Variable cleaning cycle timing, adjusted to dust load, insures constant volume of air handled and constant pressure drop across arrester.

3. Shaking and cleaning involves only one compartment at a time. During short vigorous reciprocating shaking period, reversed air flow insures cleaning of bags but in no way interrupts suction drop.

4. Any compartment may be cut out alone, for bag repair.

Write for Bulletin 164-3 giving full description.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

6422 Barberton Ave. OLympic 1-1300 Cleveland 3, Ohio

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bulletins

— Starts on page 127

REFRACTORIES & INSULATION

318—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and results. Babcock and Wilcox Co., Refractories Div.

319—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville Corp.

320—Refractories & Insulation

Catalogs R-52 through L-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

358—Heat Resistant Concrete

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

TURBINES & STEAM ENGINES

321—Steam Turbines

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Worthington Corp.

322—Multi-Stage Turbines

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diagrams, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

323—Steam Turbines

Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size for individual needs is explained. Coppus Engineering Corp.

359—Steam Turbines

If you use steam for heating, cooking, or processing, you can get power at almost no cost with the use of a Wing steam turbine according to bulletin SW-1a. Construction of these units gives an almost infinite range of speeds, easy control by throttling, and the units are independent of any electric power failure. L. J. Wing Co.

360—Turbines

Full details on this company's mechanical drive turbines are presented in a fully illustrated bulletin. These units are described as standard turbines, but "tailor-made" to your requirements. How they can be adapted to practically any operating condition or service is explained. Elliott Co., Steam Turbine Dept.

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WASTE DISPOSAL

324—Waste Treatment

How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in six-page booklet 70-B. Cross-sections show the various types of chemical and biological treatment equipment. A handy bibliography serves as a reference for more information on waste treatment in each of the industries covered. Infilco, Inc.

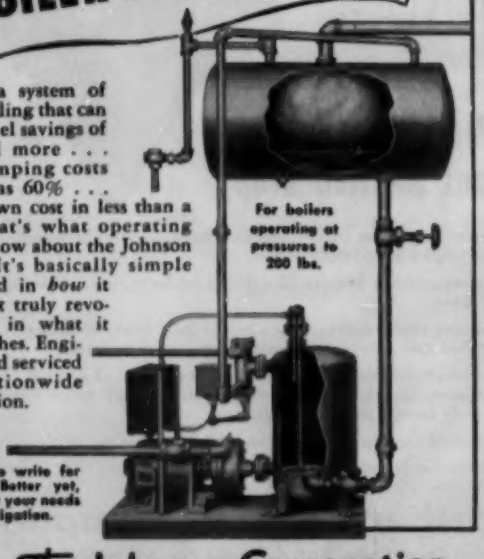
WATER TREATMENT

325—Water Analysis

Published by a company engaged ex-

REVOLUTIONARY

THE JOHNSON *High Temperature* BOILER FEED SYSTEM



Imagine a system of boiler feeding that can achieve fuel savings of 20% and more . . . slash pumping costs as much as 60% . . . save its own cost in less than a year! That's what operating records show about the Johnson System. It's basically simple and sound in *how* it works, yet truly revolutionary in what it accomplishes. Engineered and serviced by a nationwide organization.

For boilers operating at pressures to 200 lbs.

Don't fail to write for the facts. Better yet, let us survey your needs without obligation.

The Johnson Corporation

807 Wood St., Three Rivers, Mich.

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Continuous records of the oxygen dissolved in boiling feed water and of the hydrogen entrained in steam, point to the corrective measures necessary to prevent otherwise unsuspected and costly corrosion. The Cambridge Analyzers measure and record dissolved oxygen directly. The hydrogen in the steam is measure of the oxygen set free by dissociation. Cambridge Instruments are available for recording O_2 and H_2 either separately or simultaneously.

Send for Bulletin 148-BP

CAMBRIDGE INSTRUMENT CO., INC.

3460 Grand Central Terminal, New York 17

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clusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

326—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, color process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Hungerford & Terry, Inc.

327—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various conditions. National Aluminate Corp.

328—Water Treatment

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

329—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, Zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin-Refinite Div. of Elgin Softener Corp.

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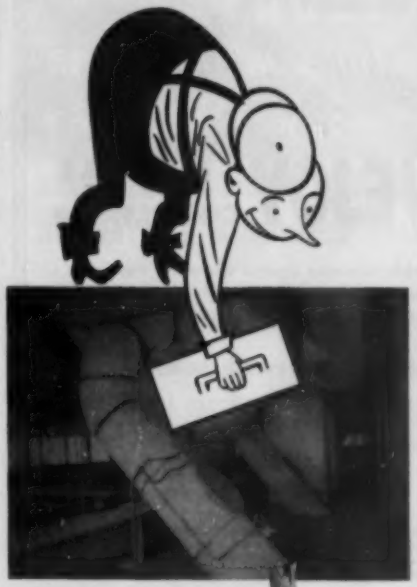

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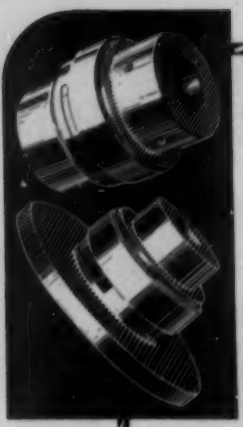

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bulletins

— Starts on page 127

361—Ion Exchanger

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

362—Deaerator

Bulletin 4643 contains complete details of a high efficiency deaeration unit for small and medium size power plants. Various types of installations are described along with the accessories necessary. Cochrane Corp.

330—Ion Exchangers

This 14-page booklet reviews generally the subject of ion exchange, established and potential applications. It gives advantages of the synthetic ion exchange resins and a bibliography of papers concerning their use. Rohm & Haas Co.

331—Water Softener

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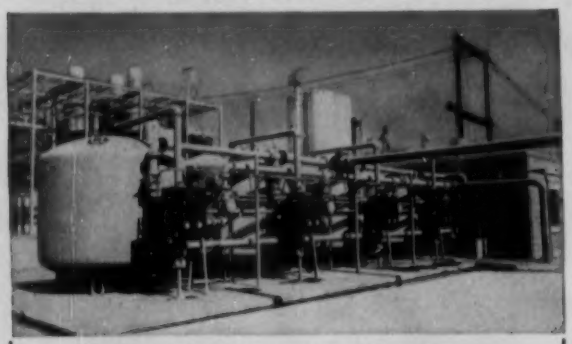

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dries, and hospitals, is described in four-page folder 4505-A. How the softener has been simplified so that installation may be handled readily by the facilities of a small or medium sized plant is explained. Cochrane Corp.

332—Water Treatment

"Industrial Water Treatment and Engineering Service," tells of the five basic lines of defense to guard against difficulties in water and steam cycles. A two-page diagram shows a water and steam cycle power plant layout and indicates the usual test required on samples taken at given points. Dearborn Chemical Co.

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MISCELLANEOUS

333—Photocopying

"The APECO Systematic Auto-Stat Story," shows you in words and pictures what the unit is, what you can copy with it, and how much time and money you can save in your office with the Auto-Stat. According to the ten-page booklet, the machine will actually enable you to have one unskilled clerk do the copying work of six expert typists. American Photocopy Equipment Co.

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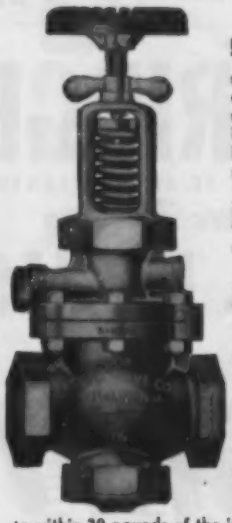

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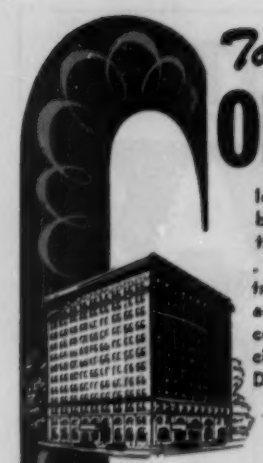

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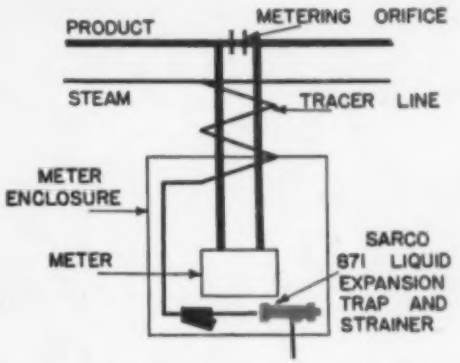


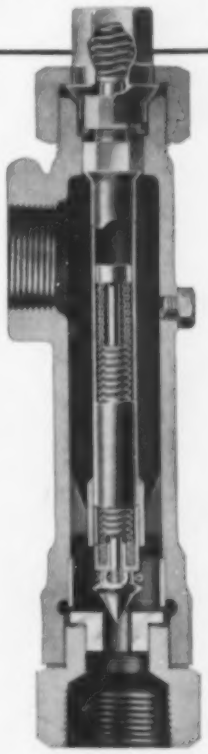
Instrument cabinet tracer line fitted with compact Sarco Liquid Expansion trap . . . discharges below 212°F, saving steam and fuel.

. . . how to be sure you select the right trap!

IT ALL DEPENDS on what you want in a trap . . . what you expect it to do. For example, if your equipment can effectively use the sensible heat of waste condensate—as in heating an outside instrument cabinet installation—then here's the right trap for you. It discharges condensate below 212°F.

The Sarco Liquid Expansion Trap, one of the five types Sarco makes to meet industry's trapping needs, has the following characteristics:

1. Discharges condensate at adjustable temperatures *below 212°F* thus saving steam and fuel.
2. Not affected by freezing weather, water-hammer, vibration, pressure pulsations, or superheat.
3. Compact: for example, ¾" size is only 8⅜" long.

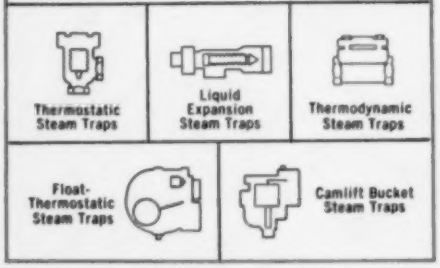


SARCO LIQUID EXPANSION THERMOSTATIC STEAM TRAP

Sizes ½" to 2", pressures to 450 psi. Write today for Bulletin 260.

Only Sarco Makes All 5 Types

That's why Sarco can give impartial advice on proper trap selection!



HELPFUL BULLETIN:

For pertinent information on trap characteristics and selection, write for Bulletin 145, "Selecting The Right TYPE Steam Trap."

ENGINEERING SERVICE:

You can count on getting unbiased advice from Sarco engineers. Next time you need help on your trapping problems, call your local Sarco representative or write Sarco Company, Inc., Empire State Building, N. Y. 1, N. Y. Representatives in principal cities.

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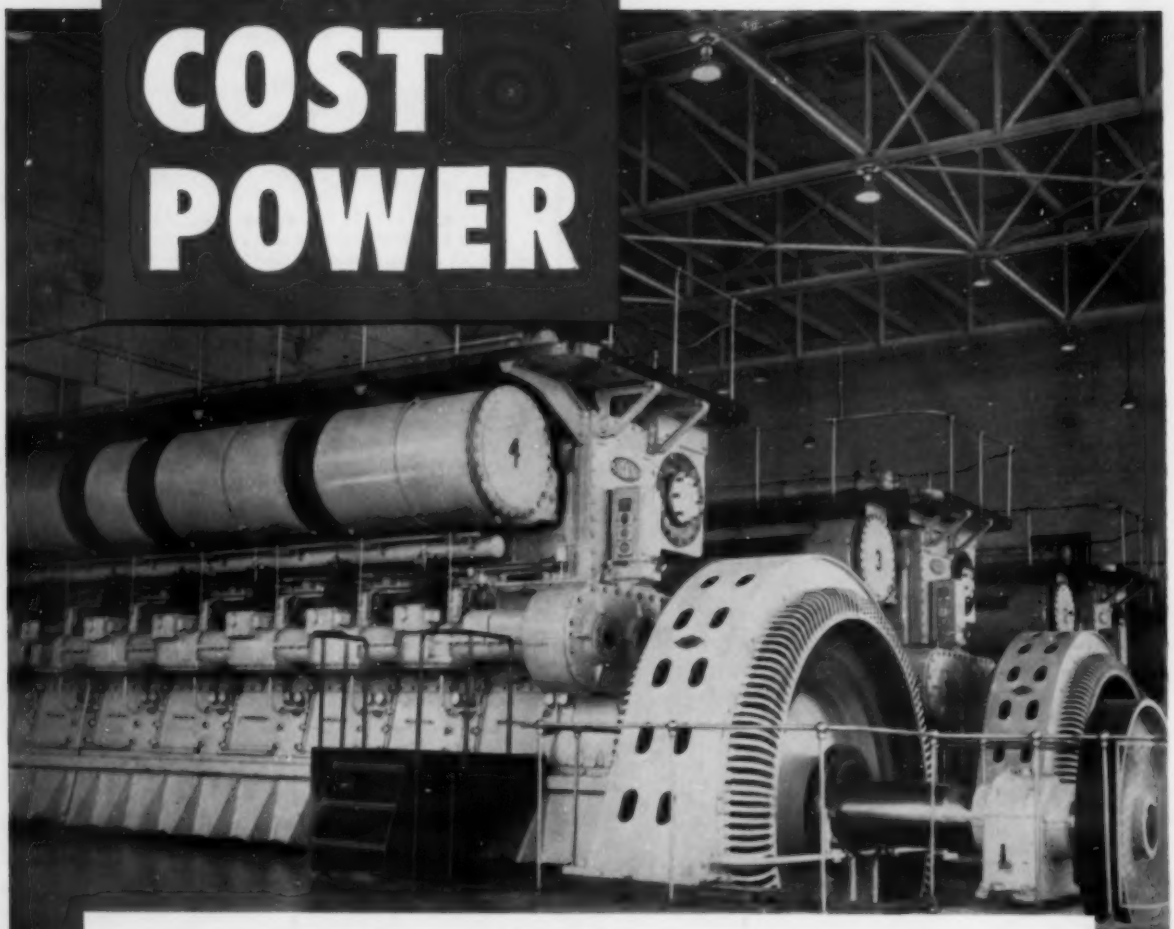

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